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CIVIL ENGINEERING.

*Extract from the Report of the General Board of Health respecting the Metropolis.—Water Supply and Drainage of Towns.**

Continued from page 6.

Professor Way was asked: "For the collection of the rain-fall of a given district, what soil would you prefer?" "I should say, decidedly, a sand. Rain-water, when collected at a distance from towns, is fit for every purpose. All that is required from the collecting surface in this case is, that it shall perform its office without imparting to the water anything to render it impure. Sands which have been washed by rain for ages are most likely to fulfil this condition, and would possess the further advantage of allowing the ready escape and collection of the water."

Specimens of surface-water collected at various points in districts surrounding London were examined; amongst these was a specimen from the Ruislip Reservoir, the water from which is used for feeding the Grand Junction Canal; this water is from the surface-drainage of a tract of clay land, and "gives 8 degrees of hardness, or just one-half the impurity from lime of all the rest of the Company's specimens put together."

The searches made south-west of the metropolis appear, however, from the nature of the strata, to be attended with the greatest promise of success. The evidence of Mr. Donaldson is given at length respecting Richmond Park as a gathering-ground, as "this one plot of land is illustrative of the principle of improved supplies." The soil of that park "is a sandy or gravelly loam, incumbent on a clay subsoil." The water drained from it was "perfectly clear, soft to the feeling, well aërated, and pleasant to

* From the London Mechanic's Magazine, for September, 1851.

drink." Mr. Donaldson said, in his evidence, "I am, from long observation, aware that water passing through a bed of vegetation does leave behind, not only the matter in mechanical suspension, but much of the matter in chemical solution. This is a point which has not hitherto received the attention which its importance deserves. I am quite sure that a bed of vegetation will detain for its food saline and other matter in solution, which no sand or other artificial filter will separate from the water. I have seen water containing a considerable quantity of sewage from a farm-yard, which has passed upon well-drained pasture land, and the water which has drained through it, has come out perfectly clear from the manure in solution."

"It is to be presumed, however, that there might be an extent of manuring, or shallowness of the filter bed of earth, which would *not* detain the matter in solution? No doubt of it." Animalculæ have never been met with by Mr. Donaldson in shallow spring-water as it came from the spring or drain.

The ordinary rain-fall at Richmond Park is estimated at 25 inches; the usual calculation of the quantity of water collected from rain-fall is the third of the amount of fall.

The Board has in review various sites in the vicinity of the metropolis which might be applicable as gathering-grounds, but give a preference to the tract "commencingwith Bagshot and Woking sands, and extending to Hampshire." Farnham has been for some time supplied with soft water by the drainage of less than two acres of the common land. The water "is delivered clear and limpid at all times of the year." "There is no reason why the same quantity of water should not be obtained from the whole of a tract of waste land there, ten miles long and five broad." "The improvement of most of these tracts has hitherto been given up in despair, and the growth of fir is recommended as the only agricultural purpose for which they are fitted." The Bagshot sands are estimated as covering an area of 300 square miles. "Beneath these sands is a retentive stratum of marl and clay, varying from five to fifteen or twenty feet in thickness."

"The portion of this district to which our attention has been more immediately directed, comprises an area of no less than 100 square miles, lying east and west of a line from Bagshot to Farnham." "Waters collected in this district at the surface, immediately after rain-fall, are of the highest degree of purity, being in large quantities not exceeding one degree of hardness."

"The chief practical result deducible from these observations is, that by arrangements for collecting the water before it has traversed any great extent of surface, a quantity sufficient, as it appears, for the domestic supply of the whole metropolis will be obtainable at a very high degree of purity, probably equal to the present supply of Farnham."

"The nature of the source requires a preservation of the rain during periods of its maximum fall, for a regulation of the supply during periods of a minimum fall. The storage-room must therefore be very extensive. The primary engineering disadvantages of this district are, that it presents no deep natural hollows, such as are available to many of the northern towns, for the storage of water without extensive excavations. Here the excavations for storage reservoirs must be very large and extensive.

Against the modern engineering practice of exposed and open reservoirs, we would rather revert to the custom of the Roman engineers, and recommend covering the service reservoirs and aqueducts to the utmost extent practicable."

"As a foundation for proximate estimates, plans have been got out by our engineering inspectors for extensive covered reservoirs, and for the conveyance of the water in deep conduits, also covered. They estimate the total expense of storing and bringing to the metropolis this new and improved supply, inclusive of reasonable compensation for waste land for reservoirs, at little more than one million sterling. We fully believe that two years' saving from the use of the purer water, would fully repay this portion of the outlay."

The Board evidently give a preference to the obtainment of water from suitable gathering-grounds, which, on account of its softness and purity, they consider as superior to that from the sources of supply indicated by Captain Veitch. This gentleman's evidence is, however, given at length in Appendix, No. 2. It appears by that evidence that he indicated several different available sources of supply, and he recommended them on account of their perennial abundance, "considering that the population of the metropolis has nearly doubled itself in 45 years," "and that great solicitude is entertained lest the same rate of increase may continue to 1890, I consider it a most important measure to secure all the best supplies of water that can be obtained near London, before they be appropriated to other objects of minor importance." The sources particularly adverted to are as follows: those at Hertford, where "there is a singular meeting of four copious streams of water proceeding from chalk valleys, viz: the Lea, the Verulam, the Beane, and the Rib, which jointly have a discharge of 9,360,000 cubic feet per diem;" "the Ash, the Stort, and springs which join the river Lea below Ware, about 4320 cubic feet of water per day. Such are the resources of the river Lea and its tributaries, and which for the paramount object of supplying the increasing population of the metropolis with so needful an element of health and consumption ought to be held sacred for that purpose alone." The conjoint waters of the river Lea, at Field's Weir, "amount to fourteen millions and a half of cubic feet, or ninety-four and a quarter millions of gallons per day." In respect to other sources, Captain Veitch said, "I conceive, in the first place, that the water of the river Verulam is the first to be secured, and rendered available for the public good at London; the water of this river taken a little above Watford, is a never-failing stream, derived from springs, and yielding three millions of cubic feet of water per diem, at an altitude of 158 feet above high water in the Thames." "Similar to the supplies of water on the north-east of London, which unite to constitute the river Lea, those on the north-west of London unite to constitute the river Colne, and consist of the following streams: The Colne proper, an insignificant brook in dry weather:" The "Verulam, a fine stream," is chiefly fed from springs, and is clear and constant, with an average yield of about 3,000,000 cubic feet per diem: The Gade, chiefly fed by springs, yields a supply of about 4,000,000 cubic feet per diem: The Chess, a lime stream fed by springs, 2,000,000 feet per diem. The above streams

have their water united a little way above Rickmansworth." The river Mole is only noticed as a probable source that may be available.

For the supply of water to the south side of the Thames, Captain Veitch had "especially directed his attention to the waters of the river Darenth," which yield about 2,600,000 cubic feet per diem." "The waters above specified," may all be delivered to reservoirs, 140 feet above high water mark. Captain Veitch was asked, "Do you not consider the above quantity of water as unnecessarily great? If water can be brought to London from such short distances, and at such an altitude on the gravitation system alone, cool and clear in quality, I do not consider that any quantity of such water, and under such conditions, can be deemed over abundant for the health of the population." The supply of water to Rome, under the Empire, "by the Roman aqueducts, amounted to about 50,000,000 cubic feet per day, for the use of a population presumed to have consisted of about 1,000,000." The population of London is now about two millions and a quarter; Captain Veitch conceives that forty years hence it may be increased to 4,000,000 of souls.

A statement of *all* the schemes that have been proposed for the supply of water to the metropolis has been drawn up by Mr. Henry Austin, and is published in the Appendix, No. 2, of the Board's Report; but as they are all of them variations only of the principal schemes, following up the Board's recommendation of gathering grounds, or deep wells, or Captain Veitch's, to take advantage of existing springs and streams, it seems superfluous in this abstract to enter into particulars of these minor schemes.

As to deep wells, it is abundantly proved that they could not afford a sufficient supply. Whether to prefer the collecting of water from gathering grounds, preserving it pure in covered reservoirs, or whether the bringing water impregnated with lime from streams affording a perennial supply, and providing for the purification from lime of the water before delivery, seems mainly a question of pounds, shillings, and pence. The greatest expense attendant on the former mode seems to arise from the immensity of reservoir required—that reservoir necessarily a *covered* one; for it is admitted, that in an *open* reservoir the water would become even more contaminated with organic impurities, animal and vegetable, than it is found to be even in the Thames. These reservoirs would have to provide not only for a sufficient supply during the dry weather of ordinary summers, but also for seasons of extraordinary drought; the leaving London so much as a single day without water, is too horrible a chance to be risked. There are some seasons when, for perhaps two months, there is no material rain-fall. How many acres of covered reservoir would suffice for the supply of London during such a drought? It is easy of calculation; so is the expense of depriving water of lime, which would be to be compared with the cost of covered reservoirs. The depriving water of carbonate of lime, by Professor Clark's process, might perhaps suffice—further purifying it in Mr. Holland's mode would add to the expense; but even that is compensated for, according to his evidence, by enabling thus the water to save soap in washing, and to require less tea, &c., in making extracts.

Should the gathering ground system be adopted, Professor Way's experiments, in addition to experience at Farnham, and to general agricul-

tural and other observations, indicate that the gathering grounds should be under the complete control of whatever person or persons may have to govern the supply of water to London; this would be essential, since those grounds should at all times be kept at a certain degree of vegetable production; enough of that growth to assimilate the whole of whatever adventitious manure might fall upon the grounds, as also any moderate quantity that might be permitted for the purpose of profitable cultivation of the area chosen as a gathering ground.

The properties desirable in water itself having been thus exhibited, and the sources from which a supply may be obtained, the next consideration is that of the most efficient and most economical mode of bringing water to the metropolis, and of distributing it therein with the greatest convenience and at the smallest cost to the inhabitants.

The General Board of Health are of opinion, that "even if the same sources of supply as those taken for the New River were eligible, and if those works belonged to the public, they ought to be abandoned, and the Roman principle of covered channels reverted to, as Captain Veitch proposes."

Captain Veitch, in his evidence, gave many particulars, showing that the mode originally adopted for the conduction of the New River was defective, on account of its being an open canal, following all the sinuosities of the ground, as on a contour line; that it had an inclination of only three inches per mile, but that "within the present century great ingenuity and great expense have been applied by the New River Company to correct the evils of the rude and vicious mode of conduit first adopted." He observed, that "a great objection to the conveyance of water for domestic purposes, in an open earthen channel, is, that the water must have a very slow motion, not exceeding half a mile per hour, to prevent the current wearing the channel-bed, and bringing in turbid water; the slow motion is again attended with serious evils, depositions of silt and decayed vegetable matter take place, which require to be cleaned out from time to time; in the warm season, so long and broad a surface exposed to the atmosphere gets heated to a degree favorable to the production of vegetable and animal life of the lower forms, and also in giving rise to a considerable quantity of waste from evaporation; the high temperature of the water rather facilitates the decoction of leaves and other vegetable matters, which get blown into the New River, to the manifest injury of the water; but there are other pollutions of a worse character, to which all open canals are subject. It is true, the New River Company have five acres of settling-grounds at Clerkenwell,* and thirty-eight at Newington, for the deposit of solid matters." "Such are the objections to all open water conduits conducted in earthen channels, the deficiencies of which will, however, be still better appreciated by a contrast with the qualifications that may be obtained for the same water, if conveyed in

* Dead dogs and cats are strained off by a grating before the water enters the settling ground at the New River Head, but other impurities cannot be so separated. A panic has sometimes been occasioned by a report that the New River was poisoned, as it happened during the excitement occasioned by Lord George Gordon's riots; all the water was then for a short time red; this, on examination, was found to have arisen from a quantity of refuse madder, thrown in from a dye-house.

covered channels constructed of stone or brickwork, and conducted in straight lines, with an uniform and efficient descent, crossing valleys on embankments or arcades, and piercing hills, by tunnels or adits; for example, the water of the river Lea might be conducted to London in such a channel from Ware, at a distance of 20 miles, instead of forty, and with a speed of one mile per hour, instead of half a mile; that is, the transit would be accomplished in twenty hours instead of eighty."

Mr. Rawlinson, in giving an account of the Croton aqueduct, instanced it as serving both as a warning and an example. The aqueduct itself has cost upwards of 40,000*l.* a mile, exclusively of reservoirs; it is supported upon a solid foundation wall, 17 feet thick; the "true aqueduct or water-way is constructed with a brick lining upon a concrete foundation." The whole structure is banked up with earth on each side. "It would be difficult to devise a more expensive work." "Nevertheless, in several instances, it has been found necessary to line the water-way with iron."

Mr. Rawlinson is of opinion that "iron, wrought and cast, may be much more extensively employed in water-works than has hitherto been the practice." "Where it is not thought advisable to cross a valley or river by an inverted syphon-pipe, an elevated wrought iron tube aqueduct may be constructed, light, elegant, nay, even graceful in structure." "Telford set an example in his celebrated Pont-y-Cypoylte aqueduct, which is 126 feet in height, 1007 feet in length, and has a cast iron water-way as sound and perfect now as the day it was made."

Mr. Rawlinson himself, in 1846, proposed a plan to the Corporation of Liverpool to bring in a supply of water from the river Dee. "The several intermediate valleys would have been crossed by inverted syphons, or by means of elevated aqueducts of wrought iron." His proposal was submitted to Mr. Fairbairn, who in his report to the Chairman of the Liverpool Water-works Committee, October, 1846, said that "tubes 6 feet deep and 2 feet wide, with close tops, can be made of sufficient strength to carry 33 tons of water on 100 feet span." "The weight of 100 feet of such a tube will be about 12½ tons."

In respect to durability, "care must be taken to prevent oxidation, and in order to do this effectually, it will be necessary to make the top of the tubes, as all the other parts, perfectly water-tight, and the tube being always full of water, it will be a great security against corrosive action in the interior. On the outside the usual preservatives must be applied; with these precautions, the tube might last for an almost indefinite period of time."

"The effects of winter, or the change of temperature, will not be severely felt on a long and somewhat flexible tube. Internally the temperature will not vary considerably, as it never can be above 60°, and never lower than 32°."

Thus it seems that Mr. Fairbairn is in favor of iron tubes.

Mr. Rawlinson appears to advocate economy in public works. He said that "If modern science has taught us how to make a steam engine, it has not yet fully inculcated the necessity there is that rigid economy should be studied in all engineering works." He gives the aqueduct of Spoletto as an example of the small quantity of masonry that suffices for

piers. "The middle arch of that structure is 328 feet in clear height, supported on piers 10 feet 6 inches thick." The Pont du Gard, near Nismes, France, might also have been noticed for the small quantity of masonry in its piers; in this instance they have occasionally to resist the immense force with which the waters of the Gardon come down suddenly upon the piers after storms in the mountains, converting a shallow brook into an impetuous broad river.

The mode of execution the Board prefers is not indicated in their Report; but it is said that, from proximate plans and estimates, "got out by our engineering inspectors for extensive covered reservoirs, and for the conveyance of the water in deep conduits, also covered," they estimate the "total expense of storing and bringing to the metropolis this new and improved supply, inclusive of reasonable compensation for waste land for the reservoirs, at little more than one million sterling." The Board, in their twenty-fifth question to Mr. Stirrat, of Paisley, said—"We find at present we can cover a reservoir at about 1000*l.* an acre." Mr. Stirrat had previously observed that, "as to covering or roofing the *storage* reservoirs, that is altogether unnecessary, as nothing of the kind" (the growth of vegetation and production of animal life) "affects us in so *deep* water." So, in other evidence, it is intimated that where waters are *deep*, the evils in question do not exist. As to loss by evaporation in uncovered reservoirs, Mr. Stirrat said—"It is a great mistake to imagine that evaporation takes place to any extent, even in the height of summer, from the surface of a reservoir, where the water is of any considerable depth. The deposit of dew, I think, counterbalances it. I have one pond 10 feet deep, on which I made the experiment, and found, in the heat of summer, that in two months it did not go down one-sixteenth part of an inch; and there might have been a small escape to account for even that diminution."

Whether on *political* grounds the water-supply of London should be from one single source, or from many different sources, does not seem to have been adverted to by the Board itself, or by any of their witnesses; nor, though the water were derived all of it from one and the same source, whether it might not be expedient to convey it to town in two or more conduits, rather than by a single aqueduct. That an army of foreign invaders would easily find its way to London, and burn it, is not to be feared; but that attempts to so destroy it, should be made by its own populace, experience has proved, and that in furtherance of this scheme cutting off the water was designed. Had Lord George Gordon's riots lasted another day, the mains at the New River-head would, it was dreaded, have been cut off, though such troops as could be spared were ordered for the protection of those works. It should not be lost sight of that, in all metropolitan disturbances, a great portion of the rioters is made up of those whose object is plunder, and that plunder is facilitated by extensive conflagration. In that fearful night, when his Lordship's mob had the upper hand, no less than fourteen separate fires were counted from one house-top; and then it was that the abundant supply of water saved the town. Of late, too, when setting fire to houses was one of the projects in an intended insurrection, the water would doubtless have been cut off.

On such accounts, this political question in regard to water-supply seems well worth consideration; and it will be hereafter shown by what arrangements water might be conveyed to every part of the town, though all but a single conduit were destroyed. M. S. B.

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*Experiments on the Strength of Wrought or Rolled Iron Joists.**

Messrs. Fox and Barrett have just introduced rolled iron joists as a substitute for cast iron in the construction of their fire proof floors, designed with a view to bring the expense to the same as those of cast iron, and thus render fire proof construction with joists of *wrought iron* as inexpensive, according to their statement, as the ordinary timber floors.

On the 25th November, some experiments were made on joists of two sizes, at the Baths and Wash Houses which are now being erected for the parish of St. James, in Dufour's Place, Poland Street. The weight was applied through a lever. The following particulars have been furnished to us.

The smaller of the two joists was 5½ inches deep, and ⅜-in. thick, with flanch top and bottom, 1¾ inches wide.

Length of joists, . . . 17 feet.
Width of bearing, ... 16 "
Weight per foot run, 10 3-5 lbs.

Load on Centre.	Deflexion.	Weight per sq. ft. of floor which the load is equivalent to.
12 cwt. . .	·65 . . .	112 lb. per foot.
15	·80	140 "
18	1·00	168† "
28	1·45	260‡ "

The larger joist was 7 inches deep, and $\frac{7}{16}$-in. thick, with flanch top and bottom, 2¼ inches wide.

Length of joist, . . . 17 feet.
Width of bearing, ... 16 "
Weight per foot run, 16¾ lbs.

Load on Centre.	Deflexion.	Weight per sq. ft. of floor which the load is equivalent to.
12 cwt. . .	·42 . . .	112 lb. per foot.
28	·785 . . .	260 "
32	·90	300† "
40	1·10	370§ "

AMERICAN PATENTS.

List of American Patents which issued from December 9, 1851, to January 6, 1852, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

21. For an *Improved Revolving Reverberatory Furnace;* Ambrose S. Beadleston, Au Sable Forks, New York, December 9.

Claim.—"What I claim as my invention is, the rolling or revolving furnace revolving on friction wheels or rollers, or their equivalent, in combination with an ordinary fire, such as is used in reverberatory furnaces, the two being combined in such a manner that the

* From the London Builder, No. 460.

† Up to this point the elasticity of the metal was uninjured.

‡ Permanent set on removal of load, ·075. A load of 18 cwt. on the centre was left on 18 hours, but produced scarcely any perceptible difference.

§ Permanent set on removal of load, ·062.

products of combustion, heated gases, etc., from the grate, shall pass into the interior of said rolling or revolving furnace, substantially as herein described; said rolling or revolving furnace being applicable to any purpose for which ordinary reverberatory or wind furnaces are employed."

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22. For an *Improvement in Potato Diggers;* Daniel D. Bell, Wawarsing, New York, December 9.

Claim.—"What I claim as of my own invention is, the arrangement and combination of the cutting and digging cylinders with the riddles, in the manner herein set forth."

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23. For an *Improvement in the Construction of Sounding Boards for Musical Instruments;* Cornelius Bogart, Charlestown, Massachusetts, December 9.

Claim.—"What I claim as my invention is, the above described mode of constructing the sounding boards of stringed instruments, by combining or arranging together, any suitable number of pieces of wood, prepared as above, all in manner and for purpose as herein set forth."

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24. For an *Improvement in Carbonic Acid Gas Engine;* John C. fr. Salomon, Cincinnati, Ohio, December 9.

"The nature of my invention consists in a new and useful mode of application of liquified carbonic acid gas, as a thermo-mechanic motor."

Claim.—"I do not claim the invention of carbonic acid gas in its liquified or aeriform character, as a motive power; neither do I claim the use of the hydrostatic press for liquifying the gas, as these principles have long been known and commented upon by Sir Hy, Davy, Faraday, Brunel, and others: but what I claim as my invention is, 1st, a carbonic acid gas engine, in which said fluid passes, from a reservoir where it exists in a liquid state, through suitable valves into a heated cylinder; thence into a refrigerator, where it is cooled, and thence through pumps, where it is condensed by hydrostatic pressure, and forced back again to the reservoir before named; the said engine being constructed substantially as herein described.

"2d, The combination of crimped leather washers, a spiral spring, or springs, and oil, or any lubricant, for packing the piston rods or plungers, as described."

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25. For an *Improvement in Gas Regulators;* Jotham S. Conant, Lowell, Massachusetts, December 9.

"The nature of my invention consists in interposing between the gas pipe from the gas works, and the main gas pipe in a dwelling, or other building, where gas is consumed, a small gasometer combined with a regulating valve, in such a manner, that the pressure of the gas in the pipe within said dwelling or other building, can be adjusted to any degree of pressure, and will remain at precisely the same amount of pressure, whether a large or a small number of burners be supplied by the said pipe."

Claim.—"What I claim as my invention is, the closing of the valve when the fluid becomes too low in the gas regulator, for safety, by the movement of the float and the lever, and their action upon the thimble on the valve rod, substantially as herein set forth."

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26. For *Improvements in Water Metres;* John Ericsson, City of New York, December 9.

Claim.—"What I claim as my invention is, 1st, The uniform circular channel *a a*, in combination with the contracted channel *b*.

"2d, I claim the rotating paddle wheel, having paddles projecting into and working in the said uniform and contracted channels.

"3d, I claim the apertures *m* and *n*, proportioned and formed as described.

"4th, I claim the pipe *g*, with its jet *r*, for giving motion to the paddle wheel before the fluid enters through the aperture *m*.

"5th, I claim the valve *k*, by which any desirable power of jet may be obtained, before any fluid enters through *m*."

27. For an *Improvement in Chucks for Lathes;* Joseph Hyde, Troy, New York, Assignor to Thos. J. Eddy, Waterford, New York, December 9.

Claim.—"Having thus described my improved chuck, what I claim therein as new is, the mechanism herein described, or the equivalent thereof, for connecting and disconnecting, at will, the whole or any part of the screws which operate the griping jaws, with the wheel which turns them, so that the screws and jaws may be moved either separately or in connexion, or in part separate and in part connected, whereby objects of either regular or irregular shape may be chucked, either eccentrically or concentrically with the axis of the mandrel, substantially as herein described.

"I also claim the turning plate (I) of the chuck, constructed with a cog wheel on its inner face, made in segments, part of which can be withdrawn out of gear with the pinions on the carrier screws, or held in gear therewith by means of set screws and springs, or the equivalent thereof, substantially as herein set forth."

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28. For an *Improvement in Feeding Logs in Saw Mills;* Charles Ketcham, Penn Yan, New York, December 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the combination of any number of adjustable rollers, which may be set at any angle with the feed rollers, or with each other, for the purpose of feeding up the log, so that it may be cut with the curve or grain of the wood, substantially in the manner as herein set forth and described."

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29. For an *Improved Arrangement of Pans for Washing Ores, Minerals, &c.;* Sam'l. Porter, Hartford, Connecticut, December 2.

Claim.—"I do not claim the device of arranging a movable pan in a vibrating frame, and of operating the same, so as to give a double motion to the pan, since letters patent for this invention have been granted to Arnold Buffum and Philip Thorp. What I claim as my invention is, the arranging and operating of a series of ore-washing pans, or sets of pans, in a vibratory frame; said pans or sets of pans, having also an oscillating or rocking motion, in the frame, in such a manner that as the superficial portion of the contents passes freely from any one pan or set of the series into the next, the contents shall, at the same time, pass out of the latter less freely, or not at all, and *vice versa*, substantially as already described.

"2d, I claim, also, the arranging in a vibrating frame, of a series of pans, or sets of pans, one after the other, each pan or set being hung upon the frame by a separate axle, or equivalent attachment, and secured in its working position by a catch, or other equivalent means, in such a manner that each pan, or set, may be conveniently disconnected and tilted, so as to discharge its whole contents into a receptacle, separate from those of the other pans.

"3d, I claim also, the arranging of a succession of groups of pans, by a constant duplication for the subdivision of the contents, in such a manner, that the contents issuing from each pan of any one group, the last excepted, shall pass, by an equal division, into the two pans of the next succeeding group, substantially as described."

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30. For an *Improvement in Car Seats;* Ezra Ripley and E. L. Brundage, Troy, New York, December 9.

Claim.—"Having thus described the nature of our invention, what we claim as new is, the arrangement of the reversing arms pivoted midway the height of, and to the back, so as that they shall descend and slide through the pivot rollers, so as that any required height of back may be reversed from one side of the seat to the other, in the manner and for the purpose, substantially the same as described."

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31. For *Improvements in Lath Machines;* G. W. Tolhurst, Cleveland, Ohio, December 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, so arranging the frame that carries the reciprocating or chopping knives and feeding apparatus, as that whilst cutting, it shall at all times rest by its own weight on the bolt, or log, in advance of the portion thereof which is being cut, in combination with the mode as herein described, of giving to the knives carried in said frame, an alternating

drawing movement towards and from the log, independent of the downward motion or position of the frame, by which means the block may be entirely reduced to laths, while the whole weight of the knife frame is resting on it, to keep it firm and solid.

"I also claim, in combination with the cutter stock, the feeding plate for feeding up the log to the cutters, a "throw" being given to said stock for that purpose; and this I claim, whether the same is accomplished by the means herein specially set forth, or by any other means essentially the same."

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32. For an *Improvement in Running Gear of Railroad Cars;* Thomas A. Davies, City of New York, December 9.

Claim.—"What I claim as new and original is, adapting to each side of railroad car tracks, four or more wheels attached to a frame work, inflexible vertically, but with a horizontal motion, in such a manner, that in case of depressions in the rails at their joinings, or otherwise, they (the wheels) will alternately be couplets, triplets, or the like, receive the weight of the load above, and relieve the wheel passing over the depression, from the weight of the load and frame work, so that no concussive blow is struck with that weight or jar created, substantially as above described."

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33. For an *Improvement in Chair Seats;* John W. Drummond, Skaneateles, Assignor to Smith Ely, New Brighton, New York, Dec. 16.

Claim.—"What I claim as my invention is, the above combination of the frame and web, being the mode of securing the web to the frame, as herein set forth, by gluing or cementing the web into a groove in the frame."

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34. For an *Improvement in Weavers' Temples;* Elihu and Warren W. Dutcher, North Bennington, Vermont, December 16.

Claim.—"What we claim as our invention is, the roller temple, constructed as herein set forth; the roller working in a concave, so that the cloth is held at that line of the periphery of the roller which is nearest the reed, at which line the roller is enabled to perform its duty with the greatest efficiency."

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35. For an *Improvement in Combining Organs and Piano Fortes;* Richard M. Ferris, City of New York, December 16.

"The nature of my invention, which relates to the combination of certain or all of the tubes of the organ with the piano-forte, consists, not in the combination, but in the manner of effecting it, so that either the piano-forte or organ can be played separately, both at the same time by the same set of keys, or one by one hand and the other by the other hand of the player, each being provided with a separate set of keys, and either set being capable of being coupled with the other set, so as to be operated at the same time.

"It also consists in the employment of a set of pedals, for operating on certain or all of the piano-strings and organ pallets; the said pedals are capable of being coupled with either the organ or piano keys, or both, or uncoupled altogether."

Claim.—"I do not claim combining the organ and piano-forte, irrespective of the manner in which the combination is formed; but what I claim as my invention is, 1st, The whole or any number of the tubes of an organ, with a distinct set of keys, in combination with a piano-forte, having its own proper set of keys, in such a manner, that either the piano-forte or organ can be played separately, or both at the same time, by the two sets of keys, or both coupled and played by one set of keys, by means of couplers P or O, and eccentric bars, *h*, *j*, or other equivalent devices, substantially as herein described.

"2d, Coupling either or both the organ and piano with a pedal action, R, *n*, Q, and uncoupling them from it, by means of couplers T, U, acting on the keys and eccentric bars *t w*, or their equivalents, so that either the organ and piano-forte, or both, can be played upon by the pedals, substantially as herein set forth."

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36. For an *Improvement in Carriages;* Gastavus L. Haussknecht, New Haven, Connecticut, December 16.

Claim.—"What I do claim as my invention is, 1st, The employment of segments *c*, *d*,

and fifth wheels, F, G, (or parts corresponding thereto,) attached as described; the one segment, *d*, and fifth wheel F, working on pivots *f*, *n*, secured at points between the front and hind axle, such parts acting in combination with arms *j*, *p*, constructed substantially as shewn and described, for coupling the movement of two axles, or their turning appurtenances, for the purposes set forth."

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37. For *Machinery for Making Kettles and Articles of like Character, from Disks of Metal;* Hiram W. Hayden, Waterbury, Connecticut, December 16.

Claim.—"I do not claim any of the gear wheels, or pinions, nor their arrangement, except as hereafter set forth, some of these being common in ordinary lathes; but I do claim as new, 1st, The application of a rotary metallic form or mould, or successive forms or moulds, in combination with a proper tool or tools, roller or rollers, sustained, moved, and directed in a proper path, by competent mechanical means, for the purpose of operating on a disk, blank, or plate of metal, so as to reduce it gradually from the centre to the edge, at the same time forming it with straight sides by successive stages, into a complete kettle, or into any similar articles, to the forming of which the apparatus can be applied, substantially as described and shown.

"2d, The construction of the mandrel *f* 3, part of which is cylindrical, and part fitted with a short screw, 13, to take the screw of the hand wheel, *f* 2, so that great pressure may be made at the point desired, while at same time, the mandrel can be easily and quickly moved through a long distance, for the purposes as described and shown."

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38. For an *Improvement in Adjusting Lenses;* Wm. & Wm. H. Lewis, City of New York, December 16.

Claim.—"We do not claim to be the inventors of any of the parts herein described and shown; neither do we mean to limit the application of these means to cameras, but to use the same, to adjust the focal distance of lenses in optical instruments, wherever the same may be made available; what we claim as new and of our own invention is, the combination of the pin 2, spring *f*, and groove 1, with the cylinders *a* and *b*, for the purposes and as described and shown."

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39. For an *Improvement in Stethescopes;* Nathan B. Marsh, Cincinnati, Ohio, December 16.

Claim.—"What I claim as my invention is, the double branch, *c c*, connected with the main trunk *a*, so as to enable persons to use both ears simultaneously, substantially as herein set forth and described."

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40. For an *Improvement in Mineral Composition Resembling Jasper;* John Paige Pepper, New Britain, Connecticut, December 16.

Claim.—"What I claim as my invention is, the manufacture of a mineral composition, having the external characters above described, by the fusion of clay with alkali, soda, lime, and sulphate of copper, as above described, or their equivalents, and working the composition into articles of utility and ornament, in the manner above described."

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41. For *Improvements in Rotating Tumbler Locks;* David H. Rickards and Jos. F. Flanders, Newburyport, Massachusetts, December 16.

Claim.—"We do not claim a combination of geared change wheels and notched circular plates, applied together on one common arbor, so that the said change wheels and circular plates shall lay side by side on the said arbor, by which arrangement of them, they require to be removed from the arbor, in order to change the catch of any one wheel from any notch or hole of its circular plate, into any other of the notches or holes of the said plate; but what we do claim as our invention is, combining with the rotary tumblers and the change gears (arranged as set forth) the projection or tooth *r*, or its mechanical equivalent, and the sliding frame G, (or its equivalent,) for holding and guiding the tumblers during their rotations, and for moving them out of or into connexion with the change gears, all substantially as herein before specified.

"And we also claim the arrangement of the tooth or bit *c*, and the stud *g*, on a sliding and turning shaft, in combination with the arrangement of the arm E, and the tumblers, so that when a person tries to move the tumblers, he cannot get end play on the bolt, and vice versa.

"And in combination with the change gears and the arbor *e*, we claim the friction spring or springs a^1, and plate b^1, for the purpose above described."

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42. For an *Improvement in Candlesticks;* Francis A. Rockwell, Ridgefield, Connecticut, December 16.

Claim.—"I do not claim the employment of a movable detached cork or other elastic substance, over which a sliding socket is allowed to move; nor do I claim the employment of a sliding socket; but what I claim as my invention is, the employment, in the sliding socket candlestick, of elastic packing attached to the standard of the candlestick, substantially in the manner described, whereby I am enabled to support the sliding socket, prevent the leaking of the grease, and also am not obliged to use so long a sliding socket, as where a cork is inserted loose in the socket."

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43. For an *Improvement in Chimney Tops;* Chas. W. Russell, Washington, District of Columbia, December 16.

Claim.—"I do not claim either the arch B, or the end plates C, C, or the end plates *a a*, and *b b*, irrespective of the devices in connexion with them; but what I claim as my invention is, 1st, the flanches, *c c*, applied to the arch B, in combination with the end plates C C, substantially in the manner and for the purpose herein set forth.

"2d, The inclined plates *a a*, and *b b*, applied to the arch B, substantially as and for the purposes specified."

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44. For an *Improvement in Churns;* Henry Skinner, Attica, New York, December 16.

Claim.—"Having thus described the nature of my invention and improvement, I wish it to be understood that I make no claim to originality of invention in any of the individual parts of the churn, except the dasher; and this I claim, only when it is constructed with inclined perforated paddles, and tapered elbow tube L, combined, for directing the cream or milk upward, and also throwing it centrifugally against the ribs B, and concave surface of the churn tub A, during the operation of churning, in the peculiar manner herein set forth."

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45. For a *Blind and Shutter Operator;* Noah W. Speers, Cincinnati, Ohio, December 16.

"The object of my invention is to provide a simple and secure method of operating and fastening outside window shutters and blinds, without opening the windows; and I have invented the present, in view of a number of contrivances which appear to me to be lacking in strength, when force is applied, such as high winds, &c."

Claim.—"Having thus fully described the nature of my improvements in window blind operators and fasteners, what I claim therein as new is, the combination of the extension handle *k*, (provided with taper ends,) with the lever *h*, and the studs *j* j^1, or their equivalents, by which the handle can, by extension, be made to possess the requisite leverage, and by which, when the lever arrives at that portion of its sweep, corresponding to the required position of the blind or shutter, it is firmly secured in its position, and the handle placed out of the way, by the latter being thrust home against the studs, the whole being arranged substantially in the manner described."

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46. For an *Improvement in Apparatus for Pressing Garments;* Jos. W. Thorp, South Weare, New Hampshire, December 16.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, suspending the goose in a tailor's pressing machine, from a carriage traveling on rails, on the end of a vertical spindle; also arranging said spindle, so that it may be moved vertically and swivel or turn upon its axis, substantially as herein above set forth.

"I also claim arranging said goose upon the rod, passing through the forked end of said spindle, so that it may slide forward and back upon said rod, as herein above set forth.

"Furthermore, I claim the combination of a goose, arranged substantially as herein above described, so as to move in the several directions specified, with a platform box, susceptible of adjustment, as specified, and heated substantially as herein above set forth."

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47. For an *Improvement in Processes for Smelting Copper Ores;* Samuel F. Tracy, City of New York, December 16.

Claim.—"That which I claim as my invention and discovery is, the use, as a flux for ores, combined with an excess of silica, of the sub-silicate of iron, obtained from the second smelting, or from iron furnaces.

"The grinding of the regulus or mat to a powder, (instead of merely breaking it into lumps or fragments,) so that a perfect oxidation can be obtained, and leaching with water, which aids the oxidation and extracts the sulphuric acid, when generated, as that acid greatly retards the refining process, when combined with the metallic copper."

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48. For an *Improvement in Tailors' Measures;* Edward Virtue, Philadelphia, Pennsylvania, December 16.

"The nature of my invention consists in proportioning all the measures of the body of coats and vests to the measure of the breast of the individual measured. The breast measure determines all others, except the sleeve measures and length of skirts."

Claim.—"What I claim as my invention is, the mode of cutting coats and vests, by making all the principal parts to depend, in length, on the length of the breast measure, substantially as herein described."

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49. For an *Improvement in Grain Sieves;* Thos. B. Wheeler, Albany, New York, December 16.

Claim.—"What I claim as my invention is, forming sieves for separating grain from straw, chaff, and all extraneous matter, and for other analogous purposes, of sheet metal, with apertures, B, B, cut or otherwise made in it, and inclined leaves A, A, under the said apertures, of corresponding form with the apertures themselves, substantially as herein set forth."

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50. For an *Improvement in Pumps for Elevating Water Mixed with Mineral Substances;* William Ball, Chicopee, Massachusetts, December 23.

Claim.—"I claim the improvement by which the waste auriferous or earthy water, that leaks out of the shaft hole of the case A, is saved and returned into the body of the case, and the wear of the shaft hole of the chamber *q* prevented; the said improvement consisting in the chamber *q*, the wheel *r*, and the passage *t*, as combined together, connected with the case A, and the shaft of the fan wheel, and made to operate substantially as specified."

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51. For an *Improvement in Chronometric Locks;* William L. Bass, Boston, Massachusetts, December 23.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, the manner of disengaging the drop lever from the notch of the bolt, from the outside of the partition, when the clock is stopped, and preventing the same from being effected when the clock is in motion, by means of the lifting screw, in combination with the forked lever, swinging loop, and ratchet wheel, substantially in the manner above described."

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52. For an *Improved Machine for Making Leather Tubes;* Newell Wyllys, South Glastonbury, Assignor to Charles Collins and N. Wyllys, Hartford county, Connecticut, December 23.

Claim.—"Having thus described the construction and operation of my machinery for forming flexible tubes, what I claim as my invention is, 1st, the method of forming the

blanks or sheets, of the proper size and form for tubes, from leather or other suitable material, by means of the movable and stationary nippers and inclined knife, or the equivalents thereof, operating automatically, substantially as herein set forth.

"2d, I claim the method of forming flexible tubes from prepared sheets or blanks, by means of fingers, clamps, and cement, or their equivalents, acting substantially as herein set forth, to bring the edges of the sheet into contact, and to unite the same.

"3d, I claim combining in a single machine, the operations of forming the leather or other material into blanks, bringing the edges of the same into contact, and uniting them, so as to form a tube at a single operation, substantially as herein set forth.

"4th, I claim the clamp, by means of which the material is held, and upon which it is formed into a tube, constructed and operating in such manner that it shall, in addition to its movements towards the other clamp, also have a longitudinal movement to withdraw from the finished tube, substantially as described.

"5th, I claim the combination of the reciprocating diverging fingers with the reciprocating converging plates, or their equivalents, by whose action the fingers are made to seize the sheet of material, substantially as herein set forth.

"6th, I claim the method of coating the edge of the sheet with cement, by means of a roller, or its equivalent, which receives the cement, and applies it to the edge to be cemented, substantially in the manner and for the purpose herein set forth.

"7th, In combination with a clamp, or its equivalent, for supporting the edges of the sheet of material to be united, I claim a reciprocating pressing iron, actuated substantially as herein set forth, to press the edges together and to set the cement."

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53. For a *Rotary Swaging Machine;* Perry G. Gardiner, City of New York, December 23.

Claim.—"What I claim as my invention, discovery, and improvement, is, the compressing, drawing, swaging, or working into shape, wrought iron car wheels, and other metallic disks, by means of two dies or swedges, suitably shaped, one of which is forced towards the other, while it at the same time revolves on its own centre, its axis of revolution being the same as that of the disk which is acted upon; the other die being either stationary, or having a revolving motion in an opposite direction to that of the first mentioned die, and with the same axis of revolution; the said two dies or swedges operating substantially as described, and being moved by any competent arrangement of machinery, substantially as described."

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54. For an *Improvement in Suspenders;* Julius Hotchkiss, Assignor to the Hotchkiss and Merriman Manufacturing Co., Waterbury, Connecticut, December 23.

"My improvement consists in fastening the different pieces or parts of the suspender together, wherever a permanent fastening is necessary, by means of a metallic clamp of peculiar construction, made and applied."

Claim.—"What I claim as my invention is, the fastening of those different parts of a suspender to each other, which require a permanent fastening, by a metallic clasp or clamp, substantially in the manner and for the purposes hereinbefore described."

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55. For an *Improvement in Candle Making Apparatus;* Willis Hurniston, Troy, New York, December 23.

"The nature of my invention consists in the manner of wicking the mould, by suspending the candles or wick above the same when drawn, so as that the wick shall draw from a reel, and suspend it in the centre of the mould, for the next succeeding candle to be moulded thereon, in the operation of drawing the candles from the moulds."

Claim.—"Having thus described the nature of my invention, I do not wish to be understood as claiming the drawing the candles and suspending them above the moulds, whereby the latter are wicked for the casting of the next series of candles, this having been before done; but what I do claim is, the employment of gripers for griping the wicks, drawing and suspending the candles on the frame above the moulds, by means of spring bearings, by which the gripers are held firmly closed, and the candles are securely held and suspended until the next series of candles are moulded, when those suspended are cut from the wick and removed, in the manner and for the purpose described."

56. For an *Improvement in Æolian Attachments;* Gustavus W. Ingalls, Concord, New Hampshire, December 23.

Claim.—"What I claim as my invention or improvement is, the combining with the valve stem or rod, a movable bar, or any equivalent mechanism, by which such valve stem, or the head thereof, whenever desirable, may be moved out of action with the key lever, for the purpose essentially as described."

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57. For an *Improvement in Carriages;* Lewis King, Madison, New York, December 23.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the employment or use of the chain and pulley, in combination with the dogs and slide bar, constructed and operating in the manner and for the purpose substantially as set forth; the lower ends of the dogs being raised or depressed by means of the levers, operated upon by the square or loop, or any other equivalent device, and the slide bar attached to or detached from the pole by means of the levers and pawl, operated upon by the bent lever, or their equivalents."

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58. For an *Improvement in Harness Saddles;* John McLain, Circleville, Ohio, December 23.

Claim.—"Having thus fully described my improved harness saddle, and the advantages thereof, what I claim therein as new is, the sliding gauge hinge boxes, attached to the pads, so as to adjust the width of the saddle by the screws, substantially as described.

"I also claim the manner of attaching the sliding gauge hinge boxes to the pads by means of the housings between them and the top of the pad, and the set screws passing through the plate *f* and top of the pads, substantially as herein set forth."

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59. For an *Improvement in the Method of Hanging Window Sashes;* Samuel D. Nims, Palmer, Massachusetts, December 23.

Claim.—"I am aware that strips acted upon by springs have been placed in grooves in window sashes, and also in grooves in the casing, for acting on the sashes for the purpose of excluding air, and for sustaining the sashes when raised, in place of weights, and therefore I wish it to be understood that I do not claim the said arrangements as any part of my invention. But what I do claim as my invention is, the manner herein described of arranging and securing window sashes in their frames, by means of grooves in the sides of the window frame or casing, that receive the edges of the sashes, or by projections from the sides of said frame or casing, that fit into grooves in the edges of the sashes, and by making one or both sides of the window frame or casing movable and elastic, by means of the springs or their equivalents."

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60. For *Improvements in Cutters for Planing Machines;* James M. Patton and Wm. F. Fergus, Philadelphia, Pennsylvania, December 23.

"The nature of our invention consists in the peculiar construction and operation of a cutting insirument to be employed in planing machines, for reducing the boards to an uniform thickness, and in a modified form, for reducing the boards to an uniform width, and for tonguing and grooving them."

Claim.—"We do not claim the formation of cutters by placing circular saws obliquely upon their arbors, as this has been done before; but what we do claim as our invention is, the constructing of a cutting instrument for operating upon lumber, of one or more elliptical shaped saw or saws, placed upon an arbor, in positions so oblique to the direction of its axis as to bring every portion of the periphery of said saw or saws into the same perpendicular distance from the said axis of their arbor, by which the teeth of the said saw or saws are made to perform a combined rotary and laterally reciprocating cutting action in the same circle of rotation, substantially in the manner herein set forth."

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61. For an *Improvement in Apparatus for Making Wrought Iron direct from the Ore;* James Renton, Newark, New Jersey, December 23.

Claim.—"I do not wish to limit myself to the use of a puddling furnace for the final operation, nor to the use of mineral coal, as the same result, in kind, may be produced by

a bloomery. What I claim as my invention is, the arrangement of a series of flat vertical tubes, or the equivalent thereof, in a vertical stack, substantially as described, when these are combined with a puddling or other furnace, substantially as described, by means of an interposed ore box, substantially as and for the purpose specified.

"I also claim combining with each of the deoxydizing tubes, as described, and at the middle and lower end thereof, a double inclined plane, substantially as described, to insure the equal descent of the charge of ore, as described.

"And I also claim, in combination with the series of the oxydizing tubes and the ore box, substantially as described, the employment of a series of stationary and a series of adjustable inclined planes, substantially as described, to regulate and insure the equal discharge of the ore from each, and from the whole series of tubes, as described."

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62. For an *Improvement in the Method of Setting up Ten Pins;* Thomas E. Shull, Lewistown, Pennsylvania, December 23.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, attaching the pins to a disk or plate by means of cords, in combination with the adjusting screen and guide screens, by which the pins are properly adjusted or set up on the alley, upon raising and lowering the disk or plate, as described; the disk or plate being operated by means of the cord passing over the pulleys and around the wheel, power being communicated to the shaft, or by any other mechanical means."

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63. For an *Improvement in Machines for Counting Screws and Pins;* Thomas J. Sloan, City of New York, December 23.

Claim.—"What I claim as my invention is, the cylinder or wheel formed with recesses in its periphery, for the reception of the screws or other articles to be counted, and provided with a groove for the reception of and in combination with the detector, to indicate, mark, and register the number of screws or other articles that are delivered; the whole being constructed and made to operate substantially in the manner specified."

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64. For an *Improvement in Bolt-heading Machines;* Nathan Starks, Albany, New York, December 23.

"The machine represented in the accompanying drawings is arranged to form square heads upon bolts; it consists mainly of a strong frame, to support the various moving parts of the machine; of a set of griping dies, to gripe the neck of the bolt blank, on which a head is to be formed; of the punch and its stock, for thickening or upsetting the extremity of the bolt blank; of the shaping dies, for giving form to the thickened extremity of the bolt blank, and of the mechanism by which the punch and dies are operated."

Claim.—"Having thus described my improved machine for heading bolts, what I claim therein as new is, the combination of the upsetting punch, the dies for shaping the sides of the head, the levers for working the dies, and the protuberance on the punch stock for actuating the levers, so that by the forward movement of the punch stock, the punch is caused to upset the end of the bolt, and by its retrograde movement the dies are worked, which give shape to the sides of the head, as herein set forth."

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65. For *Improvements in Spinning Rope Yarns;* Richard Sands Tucker, Brooklyn, New York, December 23.

"The nature of my invention consists in spinning yarns for cordage, upon bobbins having movable head or movable heads, so that the yarn can be packed tightly upon the bobbin in spinning, and when full, the yarn can be removed from the bobbin, whereby the inner end of the thread or yarn can be hauled or drawn out, in the process of rope making, in forming the "readies" or strands of cordage; thus saving much expense in labor and bobbins, besides the great advantage of hauling or drawing out the yarns or thread from the inner end."

Claim.—"What I claim as my invention is, spinning rope yarns upon bobbins having movable head or heads, so that the yarn can be packed tightly upon the bobbin in spinning, and after spinning can be removed from the bobbin, to be transferred and hauled off into strands for cordage from the *inner* ends thereof, without unwinding, thus effecting a great saving of bobbins and labor."

66. For an *Improvement in Machines for Dressing Stone;* William Wheeler, West Poultney, Vermont, December 23.

"My improvement consists in the cylindrical tool-holder, in which the cams revolve that cause the tools to act upon the stone; the said cylinder acting as a support to the cams and shaft; and it also enables me to bring the tool on to the stone in any direction, cutting equally well when the carriage is moving forward or back, or while cutting over the top surface, or up and down the ends."

Claim.—"Having thus fully described my improvements in cutting stone by machinery, what I claim therein as new is, the cylindrical tool-holder, constructed and arranged substantially as herein set forth, so as to hold the tools or chisels, and turn them in a direction to cut either way, keeping them in such position as always to receive the blows from the cams in the same relative direction, and also incidentally to support the cam shaft, by means of the cams resting against its interior, should the cam shaft spring."

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67. For an *Improvement in Machines for Ruling Paper;* John Ames and George L. Wright, Springfield, Massachusetts, December 23.

"The machine hereinafter described is for the purpose of ruling a sheet of paper on both of its opposite pages or sides, and down the page, so as to have a heading or margin at the top of each side or page."

Claim.—"Having thus described our improvements, what we claim is, 1st, the shaft and its projections, (operating as above set forth,) or any mechanical equivalent contrivances, in combination with the carrying apparatus, or endless tapes, on which the sheets are received, moved, and introduced to the action of the ruling apparatus, such carrying apparatus being made so as to operate essentially as above described.

"And we also claim the shaft and its lifters, in combination with the carrying apparatus or endless strings, and the two sets of ruling apparatus, or contrivances for supporting and ruling the paper on both sides, as described, such shaft and lifters, or the lifting apparatus, as it may be termed, being for the purpose of changing the overlap of the sheets, in manner as herein before explained."

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68. For *Improvements in Attaching Cutters for Cutting Screws on Rails of Bedsteads;* Jacob Zimmer, Tiffin, Ohio, December 23.

Claim.—"Having thus described my improvement in securing V-shaped cutters in rotary cylinder heads for cutting screws on tenons of bedstead rails, I wish it to be understood that all I claim as my invention is, forming an opening in the end of the cylindrical head, so as to allow the cutter to be placed therein laterally, or inserted into its seat sideways, and securely confined, in the manner herein before set forth, whereby the cutter requires no adjustment, and is retained firmly in its position."

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69. For an *Improvement in Setting Mineral Teeth;* John Allen, Cincinnati, Ohio, December 23.

Claim.—"What I claim as my invention is, the new mode of setting mineral teeth on metallic plates, by means of a fusible siliceous cement which forms an artificial gum, and which also unites single teeth to each other and to the plates upon which they are set.

"I also claim to be the inventor of said cement or compound, a full and exact description of which is herein given.

"I also claim the combination of asbestos with plaster of paris, for covering the teeth and plates, for the purpose of sustaining them in their proper position while the cement is being fused."

Re-issues for December, 1851.

1. For an *Improvement in the Manifold Permutation Lock, for Doors, Vaults, &c.;* Robert Newell, City of New York; patented September 25, 1838; re-issued December 2, 1851.

Claim.—"What I claim as new and of my invention is, 1st, the application of slides or their equivalents, in combination with tumblers, each so constructed that the slides shall be set through the tumblers by a key or any arrangement of the key-bit sections, or the

equivalents of the same, and then retained as set by any competent means, so that noteh tumblers resuming their quiescent positions, they abut against the slides, and prevent the retraction of the bolt, substantially as described and shown, but independent and irrespective of the means used to secure the slide in place.

"2d, I claim the manner of fitting the slides with the eramp and nut, so as to retain the slides in the position they have been placed in by the key-bits and tumblers, as described and shown.

"3d, I claim constructing the barrel of the key-bit in such a manner, that it may be inverted with reference to the handle or shank, substantially in the manner and for the purposes herein described."

Designs for December, 1851.

1. For a *Design for Stove Registers;* David Stuart and Jacob Beesley, Assignors to William P. Cresson, Philadelphia, Pennsylvania, December 2.

Claim.—"What we claim as our invention is, the ornamental design for a register, as herein described and represented in the annexed drawings."

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2. For a *Design for Stoves;* Jeremiah D. Green, Troy, Assignor to Backus, Bacon & Co., Le Roy, New York, December 9.

Claim.—"What I claim is, the ornamental design and configuration of a cook stove, substantially the same as described and represented in the annexed drawing."

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3. For a *Design for Stoves;* Winslow Ames, Assignor to Hartshorn & Ames, Nashua, New York.

Claim.—"The said design consists of the ornamental semi-star and rays and mouldings of the end or side of the top plate, (as seen in the drawings,) the circular ornament A, and four or more surrounding ornaments, B, C, D, E, together with the mouldings of the top and bottom plate, all essentially as represented in either of the side or end views, and their sections; and such ornamental design, substantially as exhibited in the above mentioned drawings, I claim as my invention or production; and I also claim the ornamental design or configuration of the water urn, as shown in figures 1, 2, and 3."

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4. For a *Design for Frames for Presses, Mantel Pieces, &c.;* Edwin L. Freeman, Belleville, New York, December 23.

Claim.—"What I claim as new is, the design of the frame for presses, mantel pieces, &c., above described."

JANUARY, 1852.

1. For an *Improvement in Ventilating Railroad Cars;* Noble S. Barnum and Lewellyn Whitney, New Haven, Connecticut, January 6.

"My invention consists in the employment of an axle, or shaft, (which is designed to be used in connexion with the car ventilator,) and which is placed on the bottom of the car, the ends of which shaft being secured in movable or sliding boxes, which operate in combination with the loose pulleys, &c., in such a manner as to allow the cars to travel over curved tracks, without the necessity of employing elastic belts."

Claim.—"What we claim as our invention is, the employment of the shaft O, sliding boxes *g*, and the springs *k;* the whole operating in combination with the pulleys, R, T, in the manner and for the purpose herein set forth."

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2. For an *Improvement in Carriage Hubs;* Samuel S. Barry, Brownhelm, Ohio, January 6.

Claim.—"What I claim as my invention is, the combination of the conical bearing point F, (fig. 2,) the female centre, or step D, the thimble N, rollers M, and flanch E, arranged in the manner substantially as described, and for the purpose set forth."

3. For an *Improvement in the Construction of Bridges;* Wendel Bollman, Baltimore, Maryland, January 6.

Claim.—"Having thus fully described my improved construction of bridges, what I claim therein as new is, the combination of the tension rods *e*, connecting the foot of each strut with each end of the stretcher, substantially as described, by which an independent support is given to the strut carried back directly to the abutment, while, at the same time, no lateral force or strain is brought upon the abutment, as herein fully set forth."

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4. For an *Improvement in Modes of Covering Cheeses;* Upson Bushnell, Gustavus, Ohio, January 6.

Claim.—"I claim as my invention, the spring cylinder with cleats, and open at the side, in combination with the framed stool, with circular opening, to admit and hold the cylinder within the sack, while the cheese shall be passed through; all as herein described and for the purposes stated."

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5. For an *Improvement in Lock for Carriage Curtains;* George Cook, New Haven, Connecticut, January 6.

Claim.—"What I claim as my invention is, the constructing or manufacturing of coach curtain locks, each consisting of a polygonal knob and an eyelet having a polygonal central aperture of corresponding form and size, so that at certain relative positions, the knob head will pass freely through the eyelet, while in other relative positions, the knob cannot pass through the eyelet, on account of the prominence of its angles.

"I also claim attaching the knobs and eyelets to the articles which are to be thereby connected, in such relative positions, that the knob head cannot be made to pass through the eyelet, either for the purpose of connecting or disconnecting, unless the eyelet or knob is turned from its ordinary and proper position; both the knob and eyelet being constructed in the manner and for the purpose herein described."

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6. For a *Machine for Turning up the Edges of Sheet Metal Disks;* Jos. F. Flanders, Newburyport, Assignor to Franklin Roys and Edward Wilcox, Berlin, Connecticut, January 6.

Claim.—"I do not claim as my invention, the use of cylindrical rollers, for either bending or beading a circular tin plate, when held between and rotated by holders or gripers; but what I do claim is, the employment of the spherical segmental bending roller *k*, in connexion with the conic frustum roller *a*, to operate together, and so as to enable me to either turn down the flanch at a right, acute, or obtuse angle, all essentially as specified, and at the same time dispense with the necessity of having several sets of holders or gripers, to bend the tin plate against, as heretofore practised."

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7. For an *Improvement in Clover Harvesters;* Mahlon Garretson, Bermudian, Pennsylvania, January 6.

Claim.—"Having thus described my improvements in the clover head harvester, what I claim therein as new is, the lateral projections whose ends are fitted into the mortises or recesses in the shanks of the cutters, and whose upper front edges are made sharp; said projections serving the two-fold purposes of interlocking with the contiguous cutters and acting as cutters themselves, as described, for severing the heads from the stalks."

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8. For an *Improved Steam and Water Gauge;* Wm. C. Grimes, Spring Garden, Philadelphia, Pennsylvania, January 6, 1852; ante-dated July 6, 1851.

Claim.—"What I claim herein as my invention is, the combination of the elevated glass syphon, containing a portion of air above, with the metallic tubes containing water below, arranged with respect to each other and the index, as herein described, for the purpose of showing or indicating the height of the water, and also the pressure of the steam, in steam boilers, at an elevation above or at the desired distance therefrom."

9. For an *Improvement in Camphene Lamps;* R. V. De Guinon, Williamsburgh, New York, January 6.

"The object of my invention is to obviate explosion; and the nature of it consists in constructing the reservoir of the lamp with a false bottom, or chamber, communicating with which and the reservoir near the top, is a tube or passage, that serves to receive and conduct the camphene or other fluid, as it increases in volume by expansion."

Claim.—"What I claim as my invention is, constructing lamps with a lower chamber or equivalent receptacle thereto, such chamber or receptacle being connected with the reservoir near its top, by a tube or passage, or other similar communication, substantially in the manner and for the purposes set forth."

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10. For an *Improvement in the Manufacture of Railroad Chairs;* Peter P. R. Hayden, Columbus, Ohio, January 6.

"The nature of my invention consists in forming the chair out of wrought flat plate, or bar iron, made with convex raised surfaces therein, on its one side, which when the bar is cut to the required length for the formation of a chair, serve to make the lips thicker, at or near the roots, when cut and bent, without incurring any extra labor, to give additional and requisite strength at those parts."

Claim.—"What I claim as my invention is, rolling iron plates for rail road chairs, upon rollers so constructed that the portions intended to form the lips of the chair, shall have a greater thickness than the rest of the plate, substantially as herein set forth."

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11. For *Improvements in Iron Railings;* George Hess, Assignor to Sylvanus Shimer, Easton, Pennsylvania, January 6.

Claim.—"I do not claim as my invention any of the parts of the within described railing, nor any of its minor combinations separately; but I do claim a combination, consisting of the following enumerated parts, viz: the top rail with its notches and end hooks; the lower rail with its notches, end hooks, and groove; the palings with their notches, hooks and T's; the posts with their openings for the ends of the rails, and the key bar by which the rails, posts and palings are firmly fastened together; the whole constructed and arranged substantially as herein described."

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12. For an *Improvement in Daguerreotype Pictures;* Henry E. Insley, City of New York, January 6.

"The nature of my invention consists in producing an image of greater boldness and relief at the same time, casting a halo of various tints around the image, gradually blending in the dark or black outer edge."

Claim.—"What I claim as my invention is, the contracted opening to the mercury bath, and the separating or raising the plate from the contractor, during the operation of mercurializing; thus graduating the mercury upon the plate, producing the various tints, and gradually blending the outer edges of the gauge."

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13. For an *Improvement in Wool Picking Machines;* Edward Kellogg, New Hartford, Connecticut, January 6.

Claim.—"I do not claim any improvement in the feeding table, ratchet feed roller, main picking cylinder, or any separate parts of the above described machinery. What I do claim as new and as my invention, is the application and use of the comb-plate to the upper and forward edge of the shell, when combined with the compound shell, to hold the comb-plate as above described; the several parts thereof being combined for the purpose aforesaid.

"And I claim the small recess just below the upper edge of the shell, for the purpose described and set forth."

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14. For an *Improvement in the Construction of Shovels;* Hiram Kimball, Worcester, Massachusetts, January 6.

Claim.—"What I claim as my invention is, an improvement in the construction of

the common shovel, as follows, to wit: 1st, the attachment of malleable iron or other metal, consisting of the lip, the flanch, and the socket, and the mode of fastening the same to the blade, as herein before described.

"2d, The mode of fastening the lower end of the stock of the handle, by means of a socket and single strap, with the ends deflected upwards on the front and back side of the stock, and thus connecting the handle with the blade of the shovel.

"3d, The construction of the upper end of the handle, consisting of the socket, the ribs, the cylinder and the rivet, and the mode of connecting the same with the upper end of the stock, by means of the socket, as substantially and fully herein before set forth."

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15. For *Improvements in Felting Cloth;* Joseph Weight, Lawrence, Assignor to Samuel Lawrence, Boston, Massachusetts; patented in England, October 7, 1841; January 6.

Claim.—"Having thus described my improvements in the manufacture of felted fabric, I shall state my claim as follows: I do not claim the manufacture of felted cloth generally, nor do I claim the use of flat platens in felting cloth; but what I do claim is, the felting of wool or other fibrous materials, upon a woven or netted fabric, substantially as herein above set forth.

"And I also claim the use of one or more moving platens, having a reciprocating rectilinear motion, in the direction of the length of the cloth to be made, over one or more stationary platens, in combination with the endless cloth bands, operated substantially as described, for carrying forward and regulating the motion of the material, while under the action of the said platens, substantially as set forth."

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16. For an *Improvement in Breech Loading Fire Arms;* Richard S. Lawrence, Windsor, Vermont, January 6.

Claim.—"What I claim as my invention is, mounting the barrel on a spindle attached to or projecting from the breech piece, so that the barrel can be turned thereon, to carry the bore to the side of the breech, for the insertion of a cartridge, and back to close the bore against the breech piece, substantially as herein described; but this I only claim in combination with the stationary breech piece, provided with a cutting edge at the side, to cut off the rear end of the cartridge, and with a projection at the top, extending over the barrel, and grooved transversely, to receive a lip from the barrel, to bind the barrel to the breech piece, to resist the force of the discharge, as herein described."

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17. For an *Improvement in Feeding Rollers in Straw Cutters;* Nathaniel Nuckolls, Columbus, Georgia, January 6.

"My improvement consists in presenting the straw sideways to the knives, and causing it to move against stationary knives, when cutting, instead of moving the knives against the straw."

Claim.—"Having thus fully described my improved straw cutter, what I claim therein as my invention is, the enlargement of the knife grooves on the feeding cylinder in the manner and for the purpose set forth."

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18. For an *Improvement in Processes of Bleaching Ivory;* Ulysses Pratt, Deep River, Connecticut, January 6; ante-dated July 6, 1851.

Claim.—"I do not claim the bleaching of ivory upon a frame exposed to the rays of the sun passing through glass, placed above the same; but what I do claim as my invention is, the improvement in the process of bleaching ivory, as set forth in the specification, that is to say, the raising up of one edge of the piece of ivory above the plane of the frame which supports it, and sustaining it in its place, in the manner described."

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19. For an *Improvement in Pen and Pencil Cases;* John W. Ranch, City of New York, January 6.

Claim.—"I do not claim the extension case, as a sliding tube working in a case has been previously invented; neither do I claim a slide case for both pen and pencil, as that

is at present in use; but what I claim as my invention is, the collar encompassing and sliding freely on the pencil tube, said collar having a slot or recess cut through it, as shown and described, through which the spur of the pencil slide may pass, by which arrangement either the pencil slide or pen holder may be operated without interfering with each other; the collar being prevented from turning on the pencil tube by means of the spur working in the slot in the sliding tube, and also by which arrangement, I combine the extension case with the slide case, for both pen and pencil, substantially as set forth."

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20. For an *Improvement in Gold Pens;* Adam W. Rapp, Philadelphia, Pennsylvania, January 6.

"By this improvement the gold pen is made to embrace all the qualities of the quill pen, and in this, I consider, lies a superiority of my improvement over all others; but the more prominent advantage is in the saving of gold, by the reduction of the thickness at *a*."

Claim.—"Therefore what I claim as my invention and improvement in the gold pen is, reducing or thinning the sides of the pen at (*a*,) between the shoulder A, and split (*c*.) whereby the advantages above stated are fully attained, and the gold pen made to possess the qualities of the quill pen."

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21. For an *Improved Mechanical Gold Beater;* Robert B. Ruggles and Lemuel W. Serrell, Assignors to Robert B. Ruggles, City of New York, January 9.

Disclaimers and Claims.—"We do not intend to confine or limit ourselves to the application of these means to beating lumina or leaves of metal, but to use this machine to beat any article to which it may be applicable; for instance, the "turn over" motion may be applied to a plate or similar article, or articles, that require to be beat on both sides, and the arrangement herein shewn, of means for extending or decreasing a given motion, may be applied to move any article in the given direction, and extend or decrease the area of such motion, as required. And it will also be seen, that this means of taking motion from the motion of the hammer tail to give definite motion from an uneven or varying motion, may be employed in other machines, for the like purposes; and we do not intend to limit ourselves to the sizes or proportions of the parts, nor their precise arrangement, relatively with each other, but to vary these as circumstances may require.

"We do not claim the hammer, or the means of moving or actuating the same; neither do we claim the use of cams to move the mould; but what we desire to secure by letters patent of the United States is, 1st, we claim the arrangement and application of the vibratory fork *g*, to take a definite amount of motion from the vibratory part g^1, of the hammer, for the purposes, and as described and shown.

"2d, We claim lifting the "mould," or its equivalent, from the anvil, and simultaneously or subsequently turning the same by competent mechanical means, substantially such as herein described, or their equivalents, so that it is replaced with the side that was previously on the anvil exposed to the blows of the hammer.

"3d, We claim the arm *n* 1, latch 30, levers *o* and *o* 2, chain 33, and crank *o* 3, or their equivalents, in combination with a weighted arm, or its equivalent, whereby a sudden partial rotation is given to the shaft *o* 1, and then the lever *o* is returned behind the latch 30, for the purposes and as described.

"4th, We claim, in combination, the lever *q*, latch 41, cranks 35, frame *t*, and links 38, or their equivalents, whereby the "mould" or its equivalent is lifted from the anvil, turned, and replaced as described.

"5th, We claim the application of the rollers 71, 72, 73, and 74, or other suitable mechanical means, set and moving at right angles with each other, and to the centre of the cam shaft, to take and communicate the motion given by a properly formed groove, or bead, in or on the face of the cam H, to the mould, so as to place it in the proper position to receive the blows of the hammer, to beat each successive quarter of the mould, as described.

"6th, We claim moving the mould, or its equivalent, over areas of different size, by means of the same cam, through the agency of mechanical contrivances substantially such as herein described, applied to the devices which transmit motion from the cam to the mould.

"7th, We claim the arrangement of the slides *y y* 1, rollers 68, forks 70, with the cranks *w* 2, *w* 3, and *v v* 1, and levers *w* and *x*, to communicate the motion given by the

cam H to the rollers 71, 72, 73, and 74, to the "mould" through its frame *s*, substantially as described and shown.

"8th, We claim the adjustable fulcrum 53, and slides *v* 4, in combination with the levers *w* and *x*, for the purposes specified.

"9th, We claim the parallel motion bars *u*, and slotted bars *u* 2, in combination with the slots 46 and 47, in the frame *s*, whereby the "mould" and frame has a free motion, at the same time that it is kept parallel with the sides of the anvil, or the slotted bar *u* 2.

"10th, We claim the arrangement of the forked springs *w* 4 and *x* 1, and pins 58, 59, and 62, 64, or their equivalents, as applied to the purpose of returning the "mould" to its central position, when commencing to beat each quarter of the "mould," as described and shown."

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22. For an *Improvement in Trucks for Locomotives;* John L. White, Corning, New York, January 6.

Claim.—"Having thus fully described my improved truck, what I claim therein as new is, the joint connecting the truck with the boiler, consisting of a long semi-cylindrical bearing and an adjustable eccentric, for putting the truck in line, substantially in the manner and for the purposes set forth."

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23. For an *Improvement in Cast Iron Car Wheels;* Horace W. Woodruff, Watertown, New York, January 6.

Claim.—"What I claim as my invention is, casting a railroad car wheel with a chilled rim and solid undivided hub, connected by means of a plate, which is single and solid at certain parts, so that imaginary radial lines from hub to rim will pass through the said solid parts, and double and bent in opposite directions, between the single and solid parts, and wholly or partly from hub to rim, substantially as specified; the whole constituting one casting, substantially as and for the purpose specified."

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24. For an *Improvement in Ventilating Windows for Railroad Cars;* Henry M. Paine, Worcester, Massachusetts, January 6.

Claim.—"I am aware that repeated attempts have been made to prevent the sparks from entering the cars, by deflecting boards or slats, but they have been outside, or independent of the windows; they could not be adjusted by the passengers themselves; they are an additional expense, and cannot effectually shield off the dust and sparks, unless they should cover the window, so as to obstruct the view therefrom; therefore, I do not wish to be understood as not claiming a deflector: but what I do claim as my invention is, the construction and arrangement of the windows of a car or carriage, in the manner and for the purpose set forth, by causing the parts of the window to stand at an angle outward when closed, and opening inward to a line with the inside of the car, as described; whereby I insure ventilation, without the annoyance of dust, by means of the window alone, without the addition of other deflectors."

LAW REPORTS OF PATENT CASES.

Battin vs. Taggert and others.

Validity of Re-issued Patents.

These were three actions at law brought by Battin, for the infringement of a patent granted to him for an improved coal breaker. The patent was originally granted on the 6th of October, 1843. On the 20th of January, 1844, certain improvements made subsequent to the date of the original patent were added to the patent. This patent was afterwards surrendered, and a new one issued on the 4th of Sept. 1849.

The three actions being for similar infringements of the same patent,

were tried together before Judge Kane and a jury in the United States Circuit Court for the Eastern District of Pennsylvania, from the 4th to the 15th of November, 1850. The cases were argued by Messrs. Keller and Dallas for the plaintiff, and by Messrs. Hughes and Mallery for the defendants. A verdict of 800 dollars was found for the plaintiff in each of the three actions.

After the verdict, the defendant filed reasons and moved for a new trial. The motion for new trial was argued before Judge Kane, from the 26th to the 30th of May, 1851, by Messrs. Shepperd and Mallery for the motion, and Messrs Porter, Cadwalader, and Dallas against the motion. Several questions were discussed during the argument, but the motion was disposed of on the ground of the invalidity of the re-issued patent. The positions taken by the respective counsel, are noticed in the opinion of the Court, which was delivered on the 10th of September last, granting the new trial.

The opinion of the Court on defendant's motion for new trial, was delivered September 10, 1851, by KANE J.

The several cases in which Mr. Battin is plaintiff, are before the Court on a motion for new trial. They were tried together, and on the trial, several points of law were reserved by the Judge, and exception was taken by the defendants to his ruling of several others. All of these have been ably reviewed in the present argument. One question, however, determines the motion, and dispenses with the consideration of the rest.

Mr. Battin obtained a patent on the 6th of October, 1843, for a new and useful improvement in the machine for breaking and screening coal, which he defined in his specification as one in which the breaking and screening were effected simultaneously by a set of breaking rollers of a certain form, operating in connexion with an assorting screen. His 'claim' was for the manner in which he had arranged and combined these together.

On the 20th of January, 1844, he described certain improvements which he had made in his machine, and caused them to be included in his patent right. These are not important to the question before us now, but the specification in which they are set out, refers to his original invention as having consisted "in the combining of the breaking and sifting apparatus with each other."

The case of Battin vs. Clayton grew out of an alleged infraction of this patent of 1843; and we held on the trial of it, that the patent being merely for the combination of machinery, it could neither be supported nor assailed by proof of the novelty or want of novelty of the parts. The patent was thereupon surrendered, and a new one issued on the 4th of September, 1849, under an amended specification, which described essentially the same machine as the former one did, but claimed as the thing invented, the breaking apparatus only.

The defendants are using this apparatus, and the jury in the several cases found against them for infractions of the re-issued patent. The damages, though liberal perhaps, do not seem to me excessive; and my own impressions are so strong, of the merits of the invention, that I have very great reluctance in disturbing the verdicts.

But there are two legal positions of a general character which appear to me to bar the plaintiff's right of recovery. They are these:

1. That a description by the applicant for a patent of a machine or a part of a machine in his specification, unaccompanied by notice that he has rights in it as inventor, or that he desires to secure title to it as patentee, is a dedication of it to the public.

2. That such a dedication cannot be revoked, after the machine has passed into public use, either by surrender and re-issue or otherwise.

The first of these propositions will hardly be disputed. If an inventor has a right at all to give up his invention to the world, there is no more unequivocal way of his doing so, than by publishing it on the records of the patent office, and at the same time making no claim to it as his exclusive property. There is no need of a formal disclaimer, where no claim can be implied; and the implication is all the other way, when of several things described, one is claimed without the rest.

The second proposition also seems to be susceptible of easy demonstration. Protection is given to an inventor under the patent laws, as the consideration for his disclosing what was not known before—not as a tribute of civic gratitude for "good deeds past." He loses his right if he allows his invention to become known before he patents it, and when he does patent it, he is required so to describe it at the very outset, that others may not only know how to use it profitably after his patent shall have expired, but be able to distinguish it from other things while his patent is in force.

These are the conditions upon which he is promised the protective intervention of the law for the secure enjoyment of his exclusive property; and they are reasonable ones. He should not be allowed on the one hand to frame his disclosure so indefinitely as to make it practically useless to the community he is contracting with, or to require them to make experiments in order to learn what his meaning was. The law of his contract assumes that his own investigations have defined the character and extent of his invention, as well as its appropriate objects, and its practical usefulness with reference to them, and that he is about to give the fruits of his experience to the world.

Not that he is required to hold back his claim of protection till he has matured or even imagined every modification of his inventive idea. He may describe and claim what he knows, and as he knows it; and leave the office of perfecting it to others. But if he does so, he must not complain that others more scientific, or more ingenious, or more practical, or more patient than himself, come after him to claim property in that which might have been his own, but which he suggested, without appropriating.

It may be that his mind is of the higher class, that distinguishes between an isolated, unreasoned fact and the illustration of a principle, and the knowledge which he imparts takes the form therefore of a general instead of a particular truth; and such also may then be the character of his patent. But what he has discovered he must in every case announce and describe, if he asks for it protection as his property. He may not mystify where he cannot teach; he is not to shut out others from the field of invention, except so far as he has occupied it himself and marked its boundaries.

Nor should he be allowed on the other hand, to defer the assertion of

his right, till others have been led by his silence to regard it as waived in their favor, and to make investments of capital, industry, or skill on the faith of such a waiver. The protection of skill, in its broader sense, is the peculiar object of the whole system of patent laws; and it would be specially unjust to the men who represent the skill of community, that they should be invited to elaborate the unclaimed suggestions of a patentee, and be precluded afterwards from using the results of their own invention by finding them embraced in the more general expression of his discovery, as set out in an amended specification—that very expression suggested in its turn perhaps by what they had done and published, or perhaps even patented themselves. The general rule is therefore a just as well as a long established one, that the patentee must stand or fall, according to the assertions of right, that he has made in his application.

The exceptions harmonize in principle with the rule. They apply to those cases, in which there has been formal error, which may be amended of course; or those in which the patentee has by inadvertence described his invention imperfectly, and offers a more accurate description as a consideration of the grant for the amended patent; or those in which, having ignorantly claimed more than he was entitled to, he desires formally to acknowledge his mistake, and renounce the right he had asserted. In the first of these cases, good faith exacts that he be allowed to repair the error; in each of the others, the public is to be a party benefitted by the modification of his patent right.

The Act of 1836 provides therefore, (Sect. 13,) that whenever a patent shall be inoperative or invalid, by reason of a defective or insufficient description or specification, or by reason of the patentee claiming in his specification as his own invention more than he had a right to claim as new, if the error has arisen from accident, inadvertency, or mistake, and without fraudulent or deceptive intention, a new patent may issue to the inventor for the same invention, in accordance with a corrected description and specification for the residue of the unexpired term, or, if the original claim has been so framed that the erroneous part of it may be stricken out without impairing the full and intelligible import of the rest, the patentee may, under the 7th Section of the act of 1837, file a disclaimer, in lieu of an amended specification.

But neither of these sections authorizes a change in the character of the claim—the substitution of a different patentable subject. The defect to be remedied, is either some insufficiency of description or an error in claiming too much. The patentee may make his specification more accurate, or he may restrict the limits of his claim, but a disclaimer cannot expand his right; and his re-issued patent taking the place of the one he has surrendered, must be for the same invention which he sought to patent from the first.

Were the law otherwise, it would be a perilous thing to admit of improvements in the machinery and processes of our workshops. There would be no knowing what was patented and what public; an inventor would have only to amplify his description and illustrate it well by drawings and models, postponing his claim to some part or other of it until it had passed into use, to be secure of many perfectly legitimate rights of action, for discussion afterwards in the Courts, or more profitable adjustment by compromise.

It is no answer to this, that such a course would be fraudulent; for how is such a fraud to be detected? Can the Commissioner refuse an amendment which comes to him supported by the patentee's oath, and altogether in harmony with the description, drawings, and models that accompanied his first application. Where is the proof to come from, of a "deceptive intention" on his part?

Nor is it an answer to say that, according to the 13th Section of the Act of 1836, the amended specification is to be without operation or effect, except "on the trial of actions for causes accruing subsequently." The process newly claimed may have required a large preparatory outlay, expensive buildings, peculiar machinery, large purchases of material, widely extended contracts, and the special education of skill. To apply these to their proposed use, or to continue applying them, after the specification has been amended, will constitute a "cause of action subsequently accruing," which the law will give damages for, and equity interpose to prevent. It costs some thousands of dollars to erect a machine like the defendant's, and it is valueless to him if he is not allowed to use it.

I hope that I shall not be understood as animadverting on the plantiff, in these remarks. His conduct appears to have been entirely fair, and I am truly sorry that he fails of the protection he has sought, for the want of a specification, properly drawn in the first instance. The discussion is of a principle, not of an individual case.

Nor does it really involve a question of good faith. Public policy, the safety of all who are watching the advance of art, and availing themselves of it, for the purposes of practical use, the intelligent and enterprising artificers of progress, the thinking mechanic, who labors to improve upon what is known to make things better than he finds them, the capitalist who rewards skill and labor while he shares their earnings, and the entire community, made richer, happier, wiser, and better, by the results of judiciously directed industry—all demand that a clear and definite line shall distinguish between that which is prohibited and that which is free; a line not to be varied capriciously or without full previous notice, nor with the changing opinions of individuals as to the character and extent of their exclusive interest, nor to the prejudice of any vested interest of the many.

Mr. Battin's invention, as he now defines it, was in use for nearly six years before he claimed that it was his property. He had made it known as an unprotected element of the combination he patented in 1843. It was not till 1849 that he asserted any other right in it for himself than he conceded to every body else. He cannot reclaim what he has thus given to the public.

Per Curiam. New trial granted.

MECHANICS, PHYSICS, AND CHEMISTRY.

*The Marine Steam Force of Great Britain.**

Great Britain possesses one hundred and forty-seven steam-ships, including three in Canada, and thirty-two iron steamers, eleven ranging from 1547 to 1980 tons. Of these, four were formerly 76-gun ships, and

* From the Glasgow Practical Mechanic's Journal, for August, 1851.

have now engines of 450 horse power. The largest, the Simoom, of 1980, has only 350 horse power; the Terrible, however, of 1850, has engines of 800 horse power; the Termagant, of 1547, has engines of 620 horse power; while the Arrogant, of 1872, has only 360 horse power; the Retribution, of 1641, has 400 horse power. One of the above eleven, the Penelope, was a 46-gun frigate. Fifteen from above 1200 and under 1500 tons, twenty-seven above 1000 and under 1200, twenty-three above 700 and under 1000, nine above 500 and under 700, twenty-seven from 250 and under 500, twenty-two from 150 and under 250, four from 42 to 149; three on the lakes of Canada, one of 406 and of 90 horse power, and one of 750 and of 200 horse power; twelve packets, 237 to 720, some of which are very fine vessels; 58,643 in commission, and 58,501 tons in ordinary. Of the steamships there are built of iron—the Simoom, 1984; the Vulture, 1764, both 350 horse power; the Greenock, 1418, and 550 horse power; the Birkenhead, 1405 and 556 horse power; the Niagara, 1395, and 350 horse power; the Trident, 850, and 350 horse power; the Antelope, 650, and 264 horse power; the packet Lizard, 340, and 150 horse power; the Bloodhound, 378, and 150 horse power; the Grappler, 557, and 220 horse power; the Sharpshooter, 503, and 202 horse power; the Harpy, 344, and 200 horse power; the Myrmidon, about 350, and 180 horse power, the Sphynx and Fairy, about 300, and 110 horse power; and four other smaller vessels of 20 to 9 horse power. Six of the packets are built of iron. Screw steamers on the stocks, viz., one 80-gun at Devonport, one 80-gun at Woolwich, and one 80-gun at Pembroke; in all, one hundred and fifty steamships. Then there is the mercantile steam power. The steam vessels registered in the port of London on the 1st of January, 1851, was three hundred and thirty-three: one hundred and seventeen under 100 tons, sixty-four from 100 to 200, twenty-six from 200 to 250, twenty-seven from 250 to 300, sixteen from 300 to 350, nine from 350 to 400, ten from 400 to 450, eight from 450 to 500, three from 500 to 550, seven from 550 to 600, three from 600 to 650, six from 650 to 700, two from 700 to 750, five from 750 to 800, three from 850 to 900, one from 900 to 950, eight from 1000 to 1500, six from 1500 to 1800, eleven from 1800 to 2000, and one above 2000 tons. In Liverpool there were ninety-two steam vessels: twenty under 100 tons, forty-nine from 100 to 200, twelve from 200 to 400, six from 400 to 600, three from 600 to 800, one of 1300 tons, and one of 1609 tons. At Bristol there were thirty-one steam vessels: eleven under 100 tons, fourteen above 100 tons and under 300, three from 300 to 500, two from 500 to 600, one (Great Britain) of 2936. At Hull there were thirty-four steam vessels: eight under 100 tons, seven from 100 to 200 tons, eight from 200 to 400, eight from 400 to 700, two from 700 to 1000, and one of 1320 tons. At Shields there were fifty steam vessels: forty-eight under 100 tons, one of 388, and one of 106 tons. At Sunderland there were thirty-two steam vessels under 100 tons. At Newcastle-upon-Tyne there were one hundred and thirty-eight steam vessels: one hundred and thirty under 100 tons, six from 100 to 300, two from 300 to 500. At Southampton there were twenty-three steam vessels: nine under 100 tons, nine from 100 to 300, five from 300 to 500. At Glasgow there were eighty-eight

steam vessels: fourteen under 100 tons, forty-eight from 100 to 300, sixteen from 300 to 700, three from 700 to 1000, five from 1000 to 2000, two from 2000 to 2500. At Leith there were twenty-three steam vessels: eight under 100 tons, twelve from 100 to 500 tons, three from 500 to 1000 tons. At Aberdeen there were sixteen steam vessels: three under 100 tons, four from 100 to 300, three from 300 to 600, five from 600 to 1000, and one of 1117 tons. At Dublin there were forty-four steam vessels: three under 100 tons, fifteen from 100 to 300, thirteen from 300 to 500, thirteen from 500 to 800. At Dundee there were ten steam vessels: five under 100 tons, two from 100 to 300, three from 500 to 800. At other ports there were two hundred and seventy steam vessels: one hundred and thirty-nine under 100 tons, sixty-one above 100 and under 250, forty-five from 250 to 500, twenty-two from 500 to 750, and three from 750 to 1000.

"*A Description of a New Metallic Manometer, and other Instruments for Measuring Pressures and Temperatures.*" *By* M. Eugene Bourdon, *of Paris.**

In the course of manufacturing a coiled copper worm for a still, one side becoming flattened by accident, internal pressure by a force pump was applied, to restore the cylindrical form, and to the astonishment of the author, as the pressure increased, the coiled tube unwound itself. This induced further experiments, which resulted in the production of the various instruments described in the paper, an engraving of one of which will be found at page 164.†

The transverse section of the coil was that of a flattened tube, which when acted upon internally by the pressure of steam, or any other fluid, had a tendency to uncoil itself, as the density increased, and to return to its original form, on the pressure being removed. If it was exposed to external pressure, or a partial vacuum was created within it, the tendency of the tube was to coil itself up into a smaller diameter. In the former case, as the tube uncoiled itself, its sides became more convex, and its capacity became greater; and, in the latter instance, the capacity diminished as the sides collapsed and approached each other. It was on this relation between the capacity of the tube, or the amount of convexity of the sides, and the diameter of the coil, that the action of the instrument depended. If a flat band of metal was bent round a circle, its transverse form remained unaltered, but if a semi-cylindrical or gutter-shaped band, was bent into a circular coil, its convexity was diminished; and if the circle formed by it was of small diameter, the band became almost flat in the transverse direction. It being then a law of general application, that a surface which was curved in two directions could not have its curvature increased in one direction, without its curvature being diminished in the other direction, and vice versa, the action of the instruments in measuring pressure or temperature was easily understood.

The variation in the thickness, or capacity of a curved flattened tube, was shown by filling the tube with a liquid, and attaching to the centre of its external periphery, a small glass tube; when every change of cur-

* From the London Artizan for December, 1851.

† For description and illustration see Jour. Frank. Inst., Vol. xxii, p. 234.

vature produced a corresponding motion in the liquid in the tube; for as the tube was straightened its capacity increased, and as it curled up again it diminished.

The change in the thickness or capacity of the tube being proportional to the variation of its radius of curvature, it was found by experiment, that the motion of the extremities of the tube was in proportion to the pressure applied, so that the indications were equal for equal increments of pressure; this fact greatly facilitated the construction of the indicating instruments.

The simplest form exhibited was that of the steam pressure gauge, in which rather more than one convolution of flattened tube was employed; one end being attached to a stop cock, in connexion with the boiler, and the other extremity carrying an index pointer, which traversed a scale graduated to given pressures per square inch; on the steam being admitted, the tube uncoiled, and the pointer indicated the amount of pressure to which it was subjected. It is obvious that by attaching a pencil to the end of the pointer, and providing the ordinary apparatus for carrying the paper, the instrument is converted into a steam engine indicator.

When a greater range of motion was required, the lever, instead of being placed on the axis of the index, carried a toothed segment, which, working into a pinion on the spindle of the index, increased the extent of indication. This arrangement was adapted for barometers, in the construction of which the air was exhausted from the flattened tube, which was then hermetically sealed. The pressure of the atmosphere acted on the exterior, and was balanced by the elasticity of the tube, which varied in curvature with every variation in the pressure of the atmosphere.

In barometers, the tube is usually fixed at the centre, the ends being left free to move, and being connected to the ends of a lever. For marine barometers, balance weights are also provided, to counteract the weights of the ends of the tube, which would affect its accuracy, when the instrument was inclined from the perpendicular. Thermometers are constructed by filling the tube with spirits of wine, and a pirometer, for measuring high temperatures, can be formed by attaching to the instrument a platinum ball, full of air, the expansion of which, when acted upon, indicates the temperature.

The author has even constructed a model steam engine on this principle, which was exhibited at the Great Exhibition. This consisted of a steel tube, of horse-shoe shape, one end of which was fixed, whilst to the other was attached a connecting rod, taking on to a crank in the ordinary manner. An eccentric on the crank shaft moved a slide on the fixed end, to regulate the admission of the steam, and to avoid refilling the whole tube at every stroke, the tube was filled with oil. The pressure of the steam effected the one stroke, and the elasticity of the tube the other.

Mr. Brunell stated that he had tested one of Mr. Bourdon's barometers, and found it very accurate and sensitive. The heights of the floors in a house might be observed, as well as the gradients the experimenter passed over in a cab, or on a railway. In using the steam-gauge, it was necessary to avoid allowing it to become heated by the steam, which might be done by interposing a syphon, which would fill with water, and also by immersing the syphon in cold water.

It was suggested that a modification of the instrument might be used as a deep sea lead, the depth being indicated by the pressure, and the instrument being made self-registering.

The instruments were stated to be very generally adopted in France, where the government inspectors of steam engines used pressure gauges on this principle, in verifying the accuracy of all the other instruments they found attached to the engines under their inspection. At the French Exposition of 1849, M. Bourdon received a gold medal, and at the Great Exhibition in Hyde Park, he was rewarded by a Council medal.—*Proc. Inst. Civ. Eng., Nov. 18th*, 1851.

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 63.

Edward Davy's Telegraph.

The next telegraph in chronological order is that of Mr. Edward Davy, of London. The patent for this telegraph was sealed July, 1838, and published in the *Repertory of Patent Inventions*, London, July, 1839. The specifications are very voluminous, and not very intelligible. I have therefore studied it carefully, and have given the important points, and a drawing, which fully illustrates the improvements which Davy proposed, being careful not to omit any vital part of his machine. In this method of treating it, I have followed the examples of Moigno and Shellen, two of the latest writers upon the subject of the history of the telegraph.

In the telegraph of Edward Davy, the decomposing action of the galvanic current is employed to produce marks upon chemically prepared cloth, or other material; the cloth preferred by the inventor was *calico*, and the chemical substance employed by him to prepare the cloth was a solution of the iodide of potassium and muriate of lime.

He employed a local battery to produce the telegraphic signs by chemical decomposition. This battery also operated an electro-magnet, whose armature regulated the movement of the registering instrument. This battery is also connected with a short independent circuit, which is closed and opened by the movement of a magnetic needle, surrounded by a coil of copper wire, which forms part of the main circuit. He employed finger-keys to open and close the circuit; his receiving instrument being similar in principle to Cook and Wheatstone's, only closing his circuit like Mr. Morse, by the contact of solid metals, instead of mercury. When the main circuit is closed by the finger-keys, the needle is deflected which closes the short circuit; but when the main current is interrupted, the needle opens the short circuit by returning to its original position.

The cloth or other chemically prepared material is drawn between a metallic cylinder and a series of platinum rings surrounding a wooden cylinder; by these rings the current from a local battery is passed through the chemically prepared cloth to the metallic cylinder beneath, producing signs consisting of simple dashes arranged in six rows. The calico is

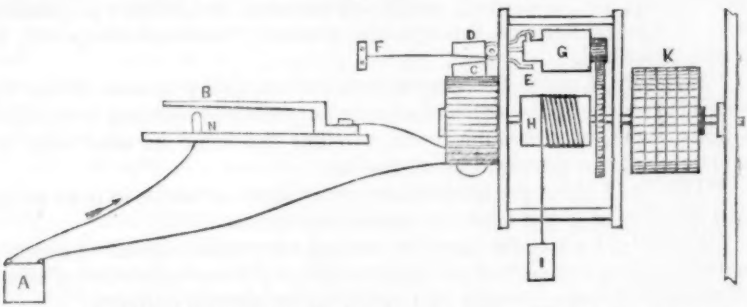
moved by clock-work, and this clock-work is regulated by a U electro-magnet, with an armature and lever, which at each motion withdraws the stop from a fly-wheel for the space of a semi-revolution, during which a single sign is made upon the calico, the clock-work moving always in proportion to the number of signs transmitted. The platinum rings were so arranged as to be connected separately or together, at will, with the other poles of the battery, but insulated from each other.

In his patent three telegraphic wires are represented, which are made by means of his commutator to connect a local circuit with either of the six platinum rings, so as to simplify the system of marking necessary to form the signs for the different letters of the alphabet.

There cannot be a doubt that Davy was informed of the telegraphs of Morse and Steinheil, by the following remarks at page 12 of his Specifications:

"I am aware that it has been proposed to use a marking instrument with lead or ink, by the aid of an electro-magnet, to make a number of dots or marks in immediate succession, to indicate the signification of such communication; I do not, therefore, claim the use of marking instruments generally, but only when they are adapted to make communications by marks across and lengthwise of the fabric which receives them, as above described."

Fig. 42.



The most ingenious portion is the escapement. The figure represents the principle of the escapement, and the electro-magnet. A is the voltaic battery; B lever; N metallic button, to which is fixed the wire conductor of the battery; C an electro-magnet; D the armature; I is a clock-weight; H the band of the wheel that carries the revolving cylinder of the signs, K; G is a van or regulator of motion; E a pair of pallets fixed to the armature D. On the side opposite the axis of motion, is fixed a spring, F, to separate the armature from the electro-magnet, by which the electric current is broken, and magnetism destroyed. The arrangement is such that for every revolution of the van G, the cylinder K advances one division, and a letter is impressed. If the lever B rests against the metallic button N, the metallic circuit of the voltaic battery is immediately established, the electric current passes along the conducting wires of the electro-magnet C, which instantly attracts the armature D, forces the superior pallet E to abandon the lever O, and permits the van to turn. As soon as it turns half a revolution, it is arrested by the inferior pallet, against which the lever touches. The contact of this lever, being aban-

doned, the voltaic circuit is instantly broken, magnetism destroyed, and the spring F leaves the armature in its first position. This movement lowers the inferior pallet, sets at liberty the lever O, and the second half of a revolution is performed, bringing it into a new position, and arrests it against lever O, or superior pallet. For each complete revolution, a character successively appears. The operation of successively elevating and depressing the key, gives the cylinder of signs a circular motion, in the same manner that the hand of a clock is made to revolve by means of balancing and escapement. On some cotton fabric are some longitudinal lines, intersected by transverse ones, dividing the surface into little squares. It is impregnated with iodide of potassium and chloride of lime, and wound on a cylinder that turns by a weight at each magnetic pulsation. The current traverses this prepared material, and leaves a well marked trace in the square indicated by the touch of the director. The position of the square in the net-work marked on the stuff, determines the letter or signal. This mode requires seven or eight lines, and has never been put in practical operation, though patented in January, 1839.

The following are the claims in full, as given in the original publication:

"First, The mode of obtaining suitable metallic circuits for transmitting communications or signals by electric currents, by means of two or more wires, which I have called signal-wires, communicating with a common communicating-wire, and each of the signal-wires having a separate battery, and, if desired, additional batteries, for giving a preponderance of electric currents through the common communicating-wire, as above described.

"Secondly, I claim the employment of suitably prepared fabrics for receiving marks by the action of electric currents for recording telegraphic signals, signs, or communications, whether the same be used with the apparatus above described or otherwise.

"Thirdly, I claim the mode of receiving signs or marks in rows across and lengthwise of the fabric, as herein described.

"Fourthly, I claim the mode of making telegraphic signals or communications from one distant place to another, by the employment of relays of metallic circuits, brought into operation by electric currents.

"Fifthly, The adapting and arranging of metallic circuits in making telegraphic communications or signals, by electric currents, in such manner, that the person making the communication shall by electric currents and suitable apparatus, regulate or determine the place to which the signals or communications shall be conveyed.

"Sixthly, I claim the mode of constructing the apparatus which I have called the escapement, whether it be applied in the manner shown, or for other purposes, where electric currents are used for communicating from one place to another.

"Seventhly, I claim the mode of constructing the galvanometer herein described.

"And lastly, I claim such parts as I have herein pointed out, as being useful for other purposes, as above described."—[*Repertory of Patent Inventions, July*, 1839.

Bain's Printing Telegraph.

The following extract of a letter is taken from a work, entitled "An

Account of some remarkable applications of the Electric Fluid to the Useful Arts: by Alexander Bain: edited by John Finlaison, Esq. London, 1843," which gives us the date of Mr. Bain's first telegraph:

"*Percival Street, Clerkenwell, Aug.* 28, 1842.

"Dear Sir:—I recollect visiting you early in June, 1840, when you showed me a model of your electro-magnetic telegraph.

"ROBERT C. PINKERTON."

In July, 1841, it was exhibited and lectured on at the Polytechnic Institution, London. It consists of three principal parts.

1st, The rotary motion given to the type wheel, step by step motion, like the second-hand of a clock, until the required letter arrives opposite the paper.

2d, The means of inking the types, or otherwise making permanent the imprint of the types upon the paper.

3d, The motion communicated to the paper, so as to bring a fresh surface under the types, and receive the printed intelligence in a continuous spiral line, until the book is filled.

He uses wire coils freely, suspended on centres, for electro-magnets. These coils, within and in the vicinity of which are fixed powerful permanent magnets, are deflected as long as the electrical current is passing through them; but when the electric current is broken, they are drawn upwards by the force of the spiral springs, the levers are released, and the machinery of the telegraph, worked by main springs, are left free to rotate. The only battery proposed by Mr. Bain is a pair of copper and zinc plates, one of which is to be buried in the earth at one station, and the other at the distant station, where there is to be a telegraph the exact counterpart of the first.

I have considered it entirely unnecessary to give a drawing of this telegraph, as it never could be of very great service; and as to the form of battery, it was entirely out of the question. The best evidence of this was, that an entire change was made in it by Mr. Bain in 1846, a description and drawing of which will be found in my article on Galvanic or Electro-Chemical Telegraphs.

I find in the same work the following account of some interesting experiments on the earth as a source of permanent voltaic electricity:

"In prosecuting some experiments with an electro-magnetic sounding apparatus, in the year 1841, it was found that if the conducting wires were not perfectly insulated from the water in which they were immersed, the attractive power of the electro-magnet did not entirely cease where the circuit was broken. For the purpose of investigating the nature of this phenomenon, a series of experiments took place, with great lengths of wire, in the reservoir of water at the Polytechnic Institution, when similar results were obtained. While reflecting upon these experiments, some few months after they had been performed, Mr. Bain was led to infer, that if a surface of positive metal was attached to one end of a conducting wire, and an equal surface of negative metal to the other end, and the two metallic surfaces put into water, or into the moist earth, (the wire being properly insulated,) an electric current would be established in the wire."

This proposition was soon tested by experiment. A surface of zinc was buried in the moist earth, in Hyde Park, and at rather more than a mile distance a copper surface was similarly deposited; the two metals were connected by a wire suspended on the railing, and on placing a galvanometer in the circuit, an electric current was produced, which passed through the intervening mass of earth from one plate to the other, and returned by the wire. In the first experiment, the metallic surfaces being small, the electric current produced was feeble; but on using a large surface of metal, a corresponding increase in the energy of the current was obtained, with which an electrotype process was conducted, and various electro-magnetic experiments performed with universal success.

It is essential to success, that the earth wherein the plates of metal are deposited should be of a moist nature. A current has indeed been obtained in dry soil, but of such small energy as to be of no practical utility.

A patent was solicited for the application of this mode of producing electric currents to his printing telegraph, and obtained in April, 1841.

This form of battery could never have been of any useful application to great distances, without an increase of the number of plates and of the exciting fluid.

Sturgeon's Electro-Magnetic Telegraph.

In the *Annals of Electricity* for October, 1840, is published a description and drawings of a form of electro-magnetic telegraph, proposed by William Sturgeon, of London, a man who has by his numerous experiments and researches into the subject of electricity and magnetism, conferred signal benefits on these important sciences, and has not received the full award of merit even from his own countrymen. The publication of the *Annals of Electricity* alone deserves the thanks of all interested in these important subjects, containing as they do a mass of valuable information not to be found elsewhere in our language.

"In describing a new electro-magnetic telegraph, I am necessarily impelled by a similar feeling to that which urged my predecessors to bring their respective inventions before the public; and I cannot resist the idea that there will be found a peculiar simplicity both in the structure and management of the telegraph I am about to describe. Indeed, I shall point out the structure of two distinct telegraphs, having the sign common to both. Also, a third, differing very materially from the other two.

"In one of these telegraphs I use six soft iron bars, bent into the form of horse-shoe magnets, and covered with copper wire spirals, in the usual way, for converting them into occasional magnets by electric currents. To each magnet is a short bar of soft iron for a keeper or cross-piece, which is attached to the shorter arm of a lever, of the first order; and to the extremity of the longer arm of the lever is attached a circular card. The arrangement of one of these pieces of apparatus is shown by figs. 44 and 45, the former being a side view, and the latter an end view of it: *m*, in both figures, represents the magnet, *i* the cross-piece, *a b* the lever, and *f* the fulcrum. The cards at the longer extremities of the six levers are numbered 1, 2, 3, 4, 5, 6, which, individually, and by a series of simple combinations, form all the signals that are required.

"When the levers are in the position shown in figs. 44 and 45, the

magnet is out of action, in consequence of the battery circuit being interrupted. If, now, the battery circuit were to be closed, the magnet *m* would immediately be brought into action, and its attractive force would bring down the cross-piece *i*; which, being attached to the shorter arm of the lever, would raise the longer arm with its card and sign, into the position of the upper dotted circle, where it becomes visible through a circular opening in the face of the instrument, as at (5) in fig. 43. When that particular sign has appeared the required time to be observed, the battery circuit is opened, the magnet *m* loses its power, and the longer arm of the lever preponderating, again falls down to its first position, and the card with its sign disappears.

Fig. 43.

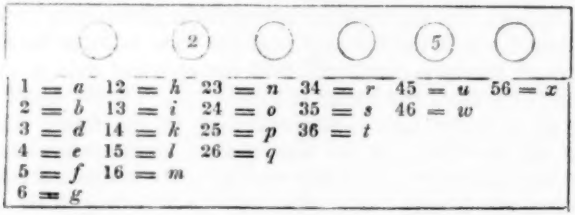


Fig. 44.

Fig. 45.

"The face or dial of the telegraph is represented by fig. 43, which may be either of painted wood or metal, silvered in the manner of clock faces, or barometer scales. On the upper part of the dial there are six circular openings, for the occasional appearance of the cards, with their figures, which are attached to the longer arms of the six levers. (See fig. 44.) Below the circular openings in the dials plate there are arranged the signals which are to represent all the alphabetical letters that are necessary for the spelling of words. The signals are thus continually before the eyes of the operator, and are too simple to miss being understood. These levers, with their magnets, &c., figs. 44 and 45, are placed behind the dial in a suitable case, and in such a manner that the figures on the cards may appear at the circular openings whenever their levers move upwards by the attractions of their respective magnets at the other, or shorter arms; and to disappear below those circular openings, when the magnets are out of action. To accomplish this latter effect, the face of the cross-piece of iron, which is attached to the short arm of each lever, must be covered by a card, or a film of some non-ferruginous matter, which will prevent close contact of the iron and magnet. By this arrangement of the apparatus, it is a matter of no consequence in what way the magnetic poles are arranged, because the attraction of the cross-pieces, attached to

the shorter arms of the levers, will take place as well with one arrangement as with another. But for uniformity, we will suppose that the coils on the magnets are all of the same kind, and that the north poles are to be in one and the same direction, towards the left hand for instance, to a person facing them, then those extremities of all the coil wires which were situated in one direction, might be collected together in one bundle, and either continued to the station where the battery is situated, or soldered to one stout copper conductor, at some short distance from the magnets, which conductor would become a general *fixed channel* between all the magnets at this station, and the battery at the other station. The other six ends of coil wires must be insulated by silk covering, and continued to the battery without metallic contact with each other. At the battery station these six insulated wires are to be attached to six wooden or ivory keys with springs, like the keys and springs of a piano forte; by the downward motion of which, the extremities of the wires become immersed in a long trough of mercury, connected with the opposite pole of the battery to that which the other conductor is attached to. On the top of each key is to be a conspicuous figure, corresponding to the figure which is to appear in the dial plate at the other station, so that when one finger is placed on key 2, and another finger on key 5, the magnets 2 and 5 at the other station are brought into play, and by attracting their respective pieces of iron, the figures 2 and 5 make their appearance on the dial as seen in fig. 43, and the letter p is understood. By these means, twenty-one of the letters of the alphabet can easily be represented without a possibility of error, either in the manipulation at the one station, or in the reading at the other; unless, indeed, there be a deficiency of attention which would incapacitate the attendants for employment at any telegraph whatever.

"The keys of this telegraph are sufficiently near to each other to permit the fingers to press on any number of them at one time, and, if necessary, the whole of the magnets may be brought into play at once, by the application of three fingers of each hand to the keys. By these means, the numerals may be grouped into combinations of three, four, five, and six, and thus, without the slightest confusion, a considerable number of signals would be obtained, which might represent words, or whole sentences, which would greatly expedite the transmission of intelligence from one end of the line to the other.

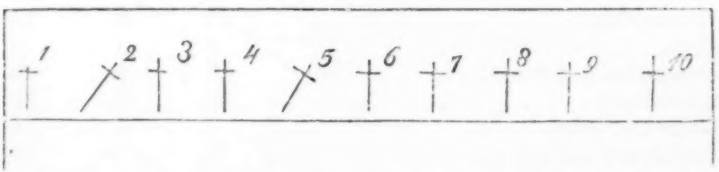
"There is a very great advantage in employing the numerals for signals. Not only because they are not so liable to lead to confusion as by the employment of the alphabetical letters, when used in combinations or groups; but because the subject of communication may be kept a perfect secret from one end of the line to the other; which is a most essential consideration in government expresses, and very often in those of mercantile affairs also.

"In this telegraph a seventh magnet is employed to ring a warning bell, as first proposed by Professor Steinheil.

"Although in the telegraph already described I employ soft iron magnets and levers to bring the signals into view, I am of opinion that magnetic needles in coiled conductors, or electro-magnetic multipliers, will be somewhat more prompt in their motions than the lever, at great dis-

tances from the battery. I therefore propose to make the necessary signals by means of magnetic needles, which can be moved with the same arrangement of conductors as that already described. And although I have only used six numerals for the signals, I am very far from supposing that the working of an electro-magnetic telegraph is facilitated or simplified by using a small number of original signals, or by having a small number of conductors. The simplest method of *spelling* words would be to have a needle for each letter of the alphabet, and the telegraph could be *made* and *worked* as easily by 24 needles as by a smaller number. And the words and sentences, which could be signified by combining them in pairs, or in groups of two each, would afford great facilities for the rapid transmission of ideas from one end of the line to the other. The needles could be placed in three horizontal rows, one above another, on a vertical dial plate.

Fig. 46.



"I have shown a dial plate in fig. 46, on which are placed 10 needles, with their respective figures or signs. As the needles can be deflected in only one direction, viz., with the north end towards the figure which belongs to it, there can be no mistake in understanding what sign is to be understood. I believe that any of these telegraphs will be found much simpler than those already before the public. They are capable of producing many more signs than any other known, and may be made at a less expense."

To be Continued.

For the Journal of the Franklin Institute.

English and American Propellers for Atlantic Navigation.

The success attending the *City of Glasgow* and *Manchester*, running to this port, and the *Glasgow* to New York, all English vessels, has led many, myself among the number, to be very much surprised at the partial failure, at least, of the *S. S. Lewis*, running to Boston, the *Pioneer*, to New York, and the *City of Pittsburgh*, to this port. And it has occurred to me that the great height of our American propellers above the water, and the consequent instability caused thereby, together with their very heavy rig, will account for the whole difference; for example, the *City of Manchester* is 274 feet long, 37¾ feet beam, and 31 feet hold, with an average draft of water of about 18 feet; while the *City of Pittsburgh* is 245 feet long, 38 feet beam, and 33 feet hold, with heavy houses on deck in addition, and to this must be added about 1½ feet as the difference of thickness of the bottom between wood and iron; her average

draft is 20 feet; it is very evident from this, that the section of the *Pittsburgh* above and below water is the greatest, which, combined with her heavy rig, must, during the prevalence of the strong westerly winds of winter, give the latter a decided advantage. The English custom, looking at the points and dimensions of their propeller ships, is to make them as low as is consistent with comfort and safety, and to obtain capacity by length. Which is right? Will some one answer? X.

For the Journal of the Franklin Institute.

Ship Building in New York for 1851.

The following is the number of vessels finished and remaining on the stocks in New York, at the close of the year 1851:

	Finished.	Unfinished.	Total.
Clipper Ships,	15	3	18
Ships,	7	1	8
Steamships and Propellers,	17	5	22
Steamboats,	20	6	26
Barks and Brigs,	3	1	4
Pilot Boats and Schooners,	21	7	28

Total, 106 vessels of all classes, whose aggregate tonnage is equal to 80,761 tons. Of the 22 vessels under the head of steamships and propellers, 17 are side wheel steamers.

The total number of side wheel sea-going steamers built up to this date is 53.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Introduction.

As much difference of opinion has prevailed of late years respecting the true forms of ships, I have been induced to make a series of experiments with models of wood, to ascertain, by a careful noting of results, what are the governing laws. And I flatter myself I have been successful, in some measure, in detecting a few of the principles which influence the speed, the stability, and the safety of vessels impelled forward by the wind, the oar, and steam.

Chapter I.

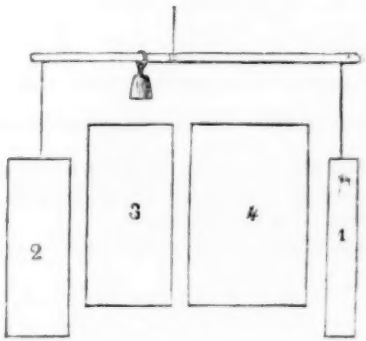
This chapter contains the particulars of experiments undertaken to gain a knowledge of the laws of water with regard to the head resistance it makes against bodies floating upon its surface, and impelled forward by some force, as the wind, the oar, and steam.

* From the London Architect, for September, 1851.

To this end, four pieces of deal were selected, of the same uniform density and thickness, and each 12 inches long, but varying in width.

No. 1 model, **2** inches wide and 12 inches long.
No. 2 model, 4 inches wide and 12 inches long.
No. 3 model, 6 inches wide and 12 inches long.
No. 4 model, 8 inches wide and 12 inches long.

These were, two at a time, attached by strings to the two ends of a balance-rod, of the length of 20½ inches; a third string, acting the part of a fulcrum whilst suspending the rod, was so put on the rod as to admit of being readily slipped along at the will of the experimenter; the other end being fastened to the small extremity of a long pole, for the purpose of reaching far enough over a pond of water to tow the models upon the surface, clear of all obstacles.



The Balance Rod.—Scale One-Twelfth.

The two models selected for experiment were then drawn on the water, and whichever of them preponderated, by meeting with greater resistance than the other, had the suspending-string shifted along the balance-rod until both the floating bodies attained an equilibrium of resistance, when the measure of their respective resistances was denoted by the inverse length of the arm or lever to which they were fastened. The shorter arm was made, in each experiment, to balance correctly the longer arm, by the means of a movable weight applied to the shorter arm.

Experiment 1.

Models.	Width.	Length.	Weight.	Difference.	Weight.
No. 1.	2 in.	12 in.	10 oz.	1⅛-inch of lever, or	2 oz.
No. 2.	4 in.	12 in.	10 oz.		

Experiment 2.

No. 2.	4 in.	12 in.	12¾ oz.	1⅛-inch of lever, or	2 oz.
No. 3.	6 in.	12 in.	12¾ oz.		

Experiment 3.

No. 3.	6 in.	12 in.	19 oz.	1⅛-inch of lever, or	2 oz.
No. 4.	8 in.	12 in.	19 oz.		

In these experiments the dimensions of the models were to each other

as 1, 2, 3, and 4; and the head resistance, compared two at a time, and of equal weight, gave the same results; consequently, the law of the head resistance is, that it increases directly with the increase of the square surface opposed; and therefore in this instance of equal additions, assumes the arithmetic ratio.

Chapter II.—Experiments made to ascertain the Law of the Resistance of Water against the Increase of Weight.

Experiment 4.—For this purpose, two model boats were selected of equal draft, and into one was put a 1 lb. weight; and being drawn on the water by the same balancing-rod which was employed in the preceding chapter, and the difference of the resistance determined as before, the law revealed itself thus:—

With 1 lb. weight, the short arm was		7½	inches long.
With 2 lb.	"	" 6½	"
With 3 lb.	"	" 5½	"

That is to say, the resistance increases directly with the weight.

Chapter III.—Of Lateral Resistance.

A ship impelled through the water by wind acting on its sails, depends for speed in no small degree upon the lateral resistance it makes, and the situation of the centre of that resistance.

The following experiments were undertaken to ascertain the law, and how influenced.

Experiment 5.—First, around and near the midship section of a model ship, was fastened, yet readily movable, one end of a line; the other end left to be taken in hand, a sufficient quantity of line being allowed between to tow the vessel through the water towards the shore, when placed at some distance from the same.

And second, the model put on the water was repeatedly drawn to the shore, and the point of fastening of the line as frequently shifted. The effects were these:

When the point of fastening was situated a trifle towards the head, the line on being pulled drew the head forward; and when fixed rather astern, then the stern was drawn forward; thus proving, there existed a point or centre of balance. By carefully moving the place of fastening, it was readily found, upon measurement, to be situated exactly in the mid-length of the keel and part of the projecting cutwater, the vessel floating upon a level keel.

During the carrying out of the above investigations, it was observed, that when the vessel was made by the line to progress forwards, as well as sideways, the centre of lateral resistance moved also forwards; and this, of course, was in consequence of its bows meeting with greater resistance than when moved exactly sideways.

The reason is obvious; first, because the water at the bows became condensed, and thus made greater resistance; and second, on account of the water being driven up against the bows, higher than the surrounding fluid, produced its effect.

The above named resistance equalled, it was found, about one-twelfth

of the length of the body immersed; but which proportion must vary, however, with the speed.

The centre of gravity in all these experiments seemed to have little or no influence with regard to the centre of lateral resistance, it being regulated by the perpendicular surface exposed to the water; and the centre of which was the centre of lateral resistance when the force of the water acted at right angles to that surface.

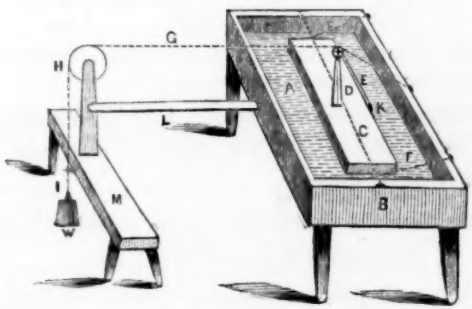
Chapter IV.—Of Stability and its Laws.

Experiments relative to the Law of Stability when the Width or Beam is increased.

For this purpose four pieces of deal were chosen, of the following dimensions:—

No.	Length.	Width.	Depth.	Weight.
1	15 in.	3 in.	2 in.	1 lb. 8 oz.
2	15 in.	4½ in.	2 in.	2 lb. 3 oz.
3	15 in.	6 in.	2 in.	2 lb. 13 oz.
4	15 in.	7½ in.	2 in.	3 lb. 7 oz.

In order to ascertain the stability of each respectively, as they in turn floated upon the water, a small movable mast, three inches high, having a hole through the top, was fixed on the upper surface, and in the centre of gravity; one end of a line was looped over a nail driven into the side of the wood, when the other end was first passed through the hole, then continued on over a pulley, and at the end a small bag was attached for the convenience of holding weights. Into the two extremities of the same piece of wood as No. 1, nails were driven lightly, and at the points where the centres of the wood cut the line of flotation. Over the heads of these nails a string of sufficient length was secured by two loops, the other ends of the strings being then made fast to nails driven into the side of the cistern of water, and at the water-level; but in the direction opposite to the string going over the pulley, with the view of counteracting the force of the weights.



A B the tank, and A, the surface of the water; C, the model; D, the mast through which the line E, G, H, I, passes, being first attached to the model by a nail at K; W, the height; M, the stool which carries the pulley; L, a shore to steady and support the pulley.

All being prepared, the weights were put into the bag until the side of the piece of wood opposite the pulley heeled down into the water to the depth of one inch, previously marked out; and by this means, the scale, as will be presently given, was obtained.

Experiment 6.—*The Scale and Table* A.

No.	Length.	Width.	Depth or thickness.	Floating depth.	Stability.	Ratio.
1.	15 in.	3 in.	2 in.	1 in.	2 oz.	1
2.	15 in.	4½ in.	2 in.	1 in.	7 oz.	3½
3.	15 in.	6 in.	2 in.	1 in.	14 oz.	7
4.	15 in.	7½ in.	2 in.	1 in.	22 oz.	11

The conclusions to be drawn from this scale are, that with the same length the ratio of stability is at its limit of rapid increase when the width is just one-third of the length; or, as 5 : 15 (see No. 2,) being nearly in the cubic ratio. Afterwards, it approaches to the arithmetic ratio.

With respect to the centre of gravity of the four pieces of wood employed upon the occasion, it is right to state they were cut from the same plank of timber, which had been selected on account of its apparent uniform density. And the models, when put on the water, all sunk down to the middle of their thickness, or just one inch out of the two; consequently, their centres of gravity were exactly level with the surface of the water.

Experiments to ascertain the Law of Stability as regards the Increase of Length, the Width and Thickness of the Floating Bodies being constant.

For this purpose, six pieces of wood (deal) were employed, and of the under named dimensions and weights.

Experiment 7.—*Scale and Table* B.

No.	Width.	Length.	Weight.	Stability.	Ratio.
1.	3 in.	3 in.	1⅜ oz.	¼ oz.	1
2.	3 in.	6 in.	2⅝ oz.	¾ oz.	3
3.	3 in.	9 in.	4 nearly	1¼ oz.	4
4.	3 in.	12 in.	5⅜ oz.	1⅜ oz.	5
5.	3 in.	15 in.	7 oz.	1⅝ oz.	6
6.	3 in.	18 in.	8¼ oz.	1¾ oz.	7

Here the scale of increase is as 1 : 3 when the length is doubled; but after this it takes the arithmetic ratio.

Further Experiments to determine how the Law of Stability operates when the Length and Width of Floating Bodies are constant, the Height or Thickness alone being varied.

The following were the dimensions of the models of deal selected:—

Experiment 8.—*Scale and Table* C.

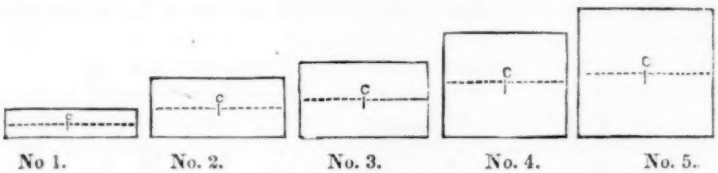
No.	Width.	Length.	Thickness.	Weight.	Stability.	Ratio.
1.	3 in.	9 in.	⅜ in.	4 oz.	1¼ oz.	2½
2.	3 in.	9 in.	1¼ in.	8 oz.	1¾ oz.	3½
3.	3 in.	9 in.	1¾ in.	12 oz.	1½ oz.	3
4.	3 in.	9 in.	2¼ in.	16 oz.	1 oz.	2
5.	3 in.	9 in.	3 in.	20 oz.	¼ oz.	½*

* Or next to nothing, being a cube.

In this table it is seen that when the thickness is in the proportion of 5 : 12 of the width (as in No. 2,) or the depth of flotation one-fifth, say, of the beam, and the centre of gravity at the water level, the stability is at its greatest.

And further, that 4 oz. in weight placed low (as in No. 1 of this table,) more than counterbalances 16 oz., as in (No. 4,) when situated high.

Midsections.—C, the centre of gravity and line of flotation.



No 1. No. 2. No. 3. No. 4. No. 5.

Scale ½-inch to 1 inch.

If these three tables be admitted as correct, it establishes the rule, that the line of flotation, with regard to depth, and as it affects stability, should be one-fifth of the breadth of the beam, when the body partakes of the parallelopiped form; the centre of gravity being preserved at or just within the level of the surface of the water of the floating body.

Let it be here repeated, relative to all the above experiments, that each piece of deal sunk in the water to half its depth or thickness; therefore, their respective centres of gravity were always on a level with the surface of the water.

To be Continued.

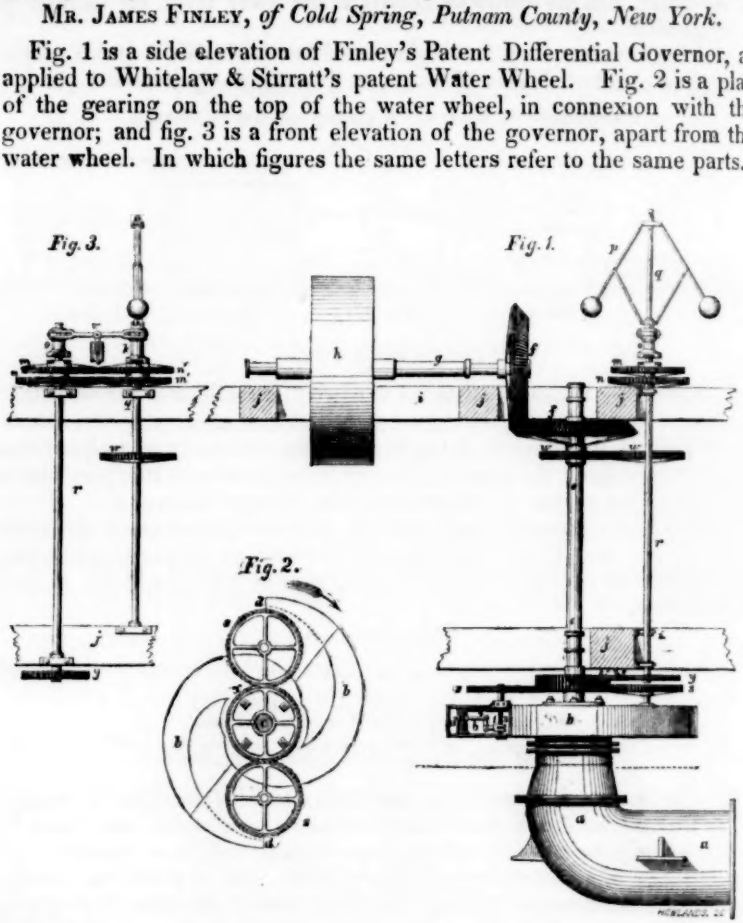
For the Journal of the Franklin Institute.

Launch of the Royal Mail Steamship Arabia.

On Wednesday last one of the new and splendid steamships, belonging to the British and North American Company's line, which have been in course of building at Greenock for some months past, was launched in the presence of a vast concourse of spectators. She is called the *Arabia*, and will be commanded by Capt. Judkins, now of the *Asia*, the veteran Commodore of the British and North American fleet of steamships. Her length is 310 feet; burthen upward of 2400 tons; and she will be fitted up with 2 side lever engines of 1000 horse power; diameter of each cylinder, 103 inches, by 10 feet stroke. The regularity and precision which have so long characterized the *Asia*, the *Europa*, and the other steamships belonging to the British and North American line, reflect the highest credit on their commanders, agents, and all parties concerned. The punctual launch of the Arabia before the close of the present year, as promised, is hailed by the shipping interest on this side as another guarantee for the continuance of that promptitude which has earned for the British North American Company and its spirited agents, Messrs. M'Iver & Co., so distinguished a reputation.

Description of a Regulator or Governor for Water Wheels. Patented by MR. JAMES FINLEY, *of Cold Spring, Putnam County, New York.*

Fig. 1 is a side elevation of Finley's Patent Differential Governor, as applied to Whitelaw & Stirratt's patent Water Wheel. Fig. 2 is a plan of the gearing on the top of the water wheel, in connexion with the governor; and fig. 3 is a front elevation of the governor, apart from the water wheel. In which figures the same letters refer to the same parts.



b b is the water wheel, *d d* the jet apertures, *a a* the main pipe, *e* the water wheel shaft, *f f* the main gearing, by which the power is transmitted to the main shaft, *g*, and drum, *h*, and from thence by a band to any machinery on which it may be intended to act. *i i* and *j j* are parts of the framing. *p* is a revolving pendulum, mounted on a spindle, *q*, which in the view shown, fig. 1, is situated beyond a second spindle, *r*, as seen in fig. 3, and is supported by a step on the upper edge of the lower frame, at *i*. This spindle is driven from the water wheel shaft by the cog wheels, *w w*, and carries two cog wheels, *m' n'*, of different sizes, which gear into two similar cog wheels, *m n*, on the spindle *r*. These wheels are reversed in position, so as to have the smaller on the one spindle, to gear into the larger on the other. *n'* and *n* are keyed fast. *m'* and *m* are

loose, but are capable of being engaged by the cluth boxes, *o* and *k*; the prongs of the latter being sufficiently long to engage *m'*, by extending down through betwixt the arms of *n'*. This clutch box is connected by links to the arms of the revolving pendulum, so as to be drawn upwards or pushed downwards, in accordance with the centrifugal action of the balls, consequent upon the variations of motion; and it is also connected with the clutch box *o*, by a double forked lever, movable on the centre *v*. The result of this connexion being to communicate to the clutch box *o*, the upward and downward motion given to the clutch box *k*, by the arms of the revolving pendulum. The motion thus communicated will be seen to be in opposite directions; the one clutch box moving upwards, whilst the other is moving downwards, and vice versa. *x* is a cog wheel, fitted loosely to a turned seat on the shaft *e*, so as to be at liberty to revolve freely round, independent of that shaft. It is connected through an intermediate stud wheel, *z z*, with a wheel *y*, which is keyed fast on the bottom of the spindle, *r*, and consequently must partake of any variation of motion that may be given to that spindle. *s s* are cog wheels which gear also into *x*, below *y* and *z*. These wheels are mounted on short spindles, which revolve in bearings attached to the water wheel, and have screws formed on the lower end; one of which is seen at 2, fig. 1. On this screw there is a nut with two projecting ears, which are embraced by the forked end of the horizontal arm of the bell crank, 1; the vertical arm of which is connected by the link, 4, with a movable adjusting plate, which forms the inside of the jet aperture at *a*. It will now be obvious, that if the cog wheel, *x*, be made to revolve in either direction, the wheels, *s s*, with their spindles, will revolve accordingly; and by the action of the screws, the nuts held by the forked ends of the bell cranks will either ascend or descend, in accordance with the direction of the motion given to *x*; and will act on the adjusting plates through the agency of the bell cranks and links, so as either to push them outwards, and diminish the width of the jet apertures, or draw them inwards, and increase that width.

Such being the general arrangement of the parts of the governor, its action may be thus explained. Assuming 37 revolutions per minute to be the proper speed of the water wheel, and also the proper speed for the revolving pendulum; let it be supposed that the water wheel having been put in operation, is making 37 revolutions per minute; it will transmit the same speed to the spindle of the revolving pendulum through the equal sized cog wheels, *w w*, and draw up the clutch box, *k*, and also the double forked lever in connexion with it, to the exact position at which they will stand under those circumstances. But by the same action the fork on the opposite end of the lever will push down the clutch box, *o*, on the spindle, *r*, to a corresponding distance. In this state of things the lever is supposed to stand in a level position, holding both clutch boxes out of gear with their respective loose wheels, *m'* and *m*, as represented in fig. 3. It will be obvious that no motion can in this case be transmitted from the spindle, *q*, to the spindle, *r*, and consequently no motion can be transmitted to the wheel, *x*. So long therefore as this state of things continues, no change can take place in the widths of the jet apertures.

Suppose now a part of the resistance to be thrown off the water wheel;

the speed will then begin to increase; but the moment that this takes place, the balls of the revolving pendulum will by their increased centrifugal action recede further from the centre of motion, and raising up the clutch box, *k*, will push down the clutch box, *o*, so as to engage the wheel, *m*. The consequence will be, a speed transmitted through the spindle, *r*, to the wheel, *x*, as much greater than the speed of the water wheel, as the wheel, *n'*, is larger than the wheel, *m*. But the wheel, *x*, being free to move, independent of the water wheel shaft, and being driven in the same direction, will have a relative motion round that shaft precisely equal to this difference of speed. For instance, should this difference be five revolutions per minute, the wheels, *s s*, will each make five revolutions per minute; which acting through the arrangement of parts already explained on the adjusting plates at *d d*, will communicate to them an outward motion, tending to increase the width of the jet apertures, and this action will continue until the water wheel resumes its proper speed; when the lever and clutch boxes will return to their former position, until another change of resistance calls for a renewed action of the governor.

Let it now be supposed that the resistance taken off, has been again put upon the water wheel, and it will be seen that an action precisely similar to what has been already described will take place, but in a contrary direction. The wheel, *x*, will then have a relative motion in a contrary direction to the motion of the water wheel, and an action will consequently be transmitted to the adjusting plates, to draw them inwards, and increase the width of the jet aperture.

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*Photography on Glass.**

Having lately had my attention drawn to the system of obtaining photographic pictures on glass, I was led, by the simplicity of the process, to make some experiments upon it, in the course of which I have succeeded in still further simplifying it. As it is highly probable that many of your readers are interested in this, as well as other branches of photography, I subjoin a description of my modifications. I shall, however, in the first place give a sketch of the mode of operating which I believe is generally adopted by amateurs as being the simplest, for the benefit of such of your readers as may be still unacquainted with this interesting and beautiful process. It is as follows:—Having precipitated an iodide of silver from a solution of its nitrate, by adding to it a solution of iodide of potassium till it is re-disolved. A little of this solution of iodide of silver is then to be added gradually to collodion (a description of which is given below,) and well shaken with it. After settling, this mixture is ready for use. Having procured a piece of plate-glass of the size required, pour over it some of the *iodized* collodion, allowing it to spread over the surface of the glass, so as to cover it completely; and then to flow off at one of the corners. After a little practice, this becomes very easy, and a fine even coating is obtained. The iodized plate is now to be immersed in a solution of nitrate of silver, 30 grains to the ounce of water, till the

* From the Glasgow Practical Mechanic's Journal, December, 1851.

solution flows evenly over its surface, and it is then ready for the camera. After removal from the camera, the picture is developed by pouring over it some of the following mixture:—

Pyro-gallic acid,	3 grs.
Glacial acetic acid,	1 drm.
Water,	1 oz.

When the picture is sufficiently developed, it is first washed with water, and the sensitive coating is removed by means of a strong solution of hyposulphite of soda. It is then to be washed again with water, and when dry, a little thin varnish may be poured over it, to protect it from being rubbed off.

I now come to describe the modifications which I have adopted, and which I find not only simpler, but productive of a better result than can be obtained by the process which I have described.

The first of these relates to the iodized collodion, and was suggested by the idea, that it was unnecessary to add iodide of *silver* to the collodion, as the addition of iodide of potassium *alone*, on immersion in the nitrate of silver, would form the required coating of iodide of silver upon the glass. On trial I found this to be the case.

At this point it may be well to make some remarks regarding the preparation of the collodion, which is of so much importance in this process. It is made, as is now generally known, from gun cotton dissolved in sulphuric ether. There is, however, considerable difference in the mode of preparing the cotton for this purpose. I find the most certain mode of obtaining very soluble cotton, is to make use of nitric acid. Equal bulks of sulphuric acid and nitre will be found to answer very well. Let the cotton be immersed in this mixture, and well saturated with it for about seven or eight minutes; then let it be taken out, and thoroughly washed in water, and dried.

We now arrive at the iodizing process, which may be simply effected thus:—To *pure* sulphuric ether add about $\frac{1}{8}$th of its bulk of alcohol, then a little iodideof potassium, and after this the prepared cotton; let these be well shaken together for some time, and then allowed to settle. Four or five grains of iodide to the ounce of ether will be found sufficient.

The admixture of alcohol to the ether seems to be necessary in preparing collodion for our present purpose, as it will be found, if *pure* ether be employed, that little or no coating will be formed on immersion in the nitrate of silver. It must, at the same time, be observed, on the other hand, that when too much alcohol is added, the coating will be too opaque, preventing the light from penetrating. Thus, little more than the surface of the sensitive coating being acted upon, it is impossible to obtain a bold picture. It is difficult, by description, to point out the depth of coating required, but a very little experience will be sufficient to determine this. The object is to avoid the extremes above mentioned, viz., the having little or no coating at all, and the having a coating too opaque.

From the difficulty I have experienced in always obtaining *pure* ether, (there being often a considerable quantity of alcohol already mixed with it,) I have been obliged to adopt the following mode of preparing iodized collodion. To 1 oz of ether add 5 or 6 grs. of iodide of potassium, and

shake them well together for some time; after settling, the iodized ether should be poured off, and some of the prepared cotton added to it till the proper consistency is attained. Now, prepare a solution of iodide of potassium in alcohol, and add this to the iodized collodion till the coating formed by immersion in the silver solution is considered sufficiently deep. This should be of a milk-like appearance, but at the same time considerably transparent, for reasons before given. By this means, I am enabled with ease, to modify my collodion so as to obtain any depth of coating I may desire; the only objection attending this *adulteration* being, the having to pay the price of ether for so much alcohol, which every one knows is considerably cheaper. My next modification is in the preparation of the developing mixture. It will be noticed that pyro-gallic acid is recommended for this purpose, the acetic acid being added to prevent the pyro-gallic from attacking the parts unaffected by light. This, in common with most other acids, it effects; but I have never been able by its use to obtain a pure white. From this circumstance, I was led to try the effects of other acids, and found nitric acid to answer my purpose. A difficulty, however, arose in the nice adjustment required in the proportions of the two acids, which induced me to try another well known developing agent, sulphate of iron, and the result obtained in this way was quite satisfactory. The proportions in this case seem to be of much less importance, so that, with very little care, an excellent developing mixture may be obtained. I subjoin the proportions which I have used with success:—

Sulphate of iron, ...	12 grs.
Nitric acid, ...	1 or 2 drops.
Water, ...	1 oz.

If, from any variation in the strength of the nitric acid, the dark parts of the picture should be spoiled by the action of the sulphate, the addition of a little more acid will be found to prevent the evil.

By means of the above modifications, I have obtained some excellent results; the whites of the picture being very pure, and of a fine metallic appearance, much resembling frosted silver. H. R.

Glasgow, November, 1851.

[We have before us some examples of our correspondent's productions, which possess an amount of brilliancy and boldness unknown in the ordinary Daguerreotype process. Few modern arts can be said to be in a state so essentially transitionary as Photography; but the introduction of glass seems to promise, in its results, to throw all previous inventions into the shade.—Ed. P. M. Journal.

For the Journal of the Franklin Institute.

Trial Trip of the U. S. Steamship "Fulton." By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

Most persons who feel interested in matters of steam navigation, will remember the old U. S. steamship *Fulton*, built about 14 years ago at the Brooklyn Navy Yard, where she has lain since that time a perfect specimen of an utter failure. She was constructed for a war sea steamer, with

which view she was fitted with two horizontal condensing engines of 50 inches diameter of cylinder, by 9 feet stroke; *the engines being placed on the spar deck; each engine working its own paddle wheel independently*, the main shaft not extending across the vessel. Such were the arrangements by which it was contemplated to make a marine war steamer fourteen years ago; the machinery wholly exposed on deck to shot, and rendered almost useless at sea by the absence of connexion between the paddle wheels, so that when one was deeply immersed by the careening of the vessel, and its engine brought to a stand by the increased resistance thrown upon it, the other, being by the same operation so relieved of its resistance that its engine would spin it around with a velocity threatening the destruction of the machinery. Moreover, this well appointed sea steamship carried fuel but for three or four days' moderate steaming. The *Fulton* was also fitted with old fashioned cumbrous *copper* boilers.

In January, 1851, the Chief of the Bureau of Construction, Equipment, and Repair of the Navy Department, (Commodore Chas. Wm. Skinner,) directed the present Engineer in Chief of the Navy, (Gen. Chas. B. Stuart,) to entirely reconstruct the machinery of the *Fulton*, so as to make an efficient war steamer of her, with high speed, and capable of carrying a large amount of fuel. A contract was accordingly made with Mr. H. R. Dunham, of New York, and all the parts of the old engines that could be used were employed; new iron boilers were constructed, and the old copper ones being sold, contributed principally to defraying the cost of the new work.

With regard to the hull, no alterations were made except to the bulwarks on the spar deck, and to the internal arrangements. The model of the hull is peculiar; the two halves from the amidship section being precisely alike and having the water lines full; a model in all respects considered very unfavorable for speed. It was not changed, however, from motives of economy.

The vessel as now finished, together with the machinery, has the following dimensions:

HULL.

Length between perpendiculars,		180 feet
Extreme beam,		34 " 9 inches.
Depth of hold,		12 "
Burthen,		750 tons.
Draft of water on trial trip,	forward,	9 feet 6 inches.
	mean,	10 "
	aft,	10 " 6 "
Immersed amidship section on trial trip,		298 square feet.
Displacement per inch of draft, at 10 feet draft,		8½ tons.
RIG.—Fore top-sail schooner.		
Fuel carried on trial trip,		220 tons anthracite.
Fuel carried with bunkers and bags filled,		275 "

ENGINE.

One condensing inclined engine.

Diameter of cylinder,	50 inches.
Stroke of piston,	10 feet 4 "
Space displacement of piston per stroke,	140·9 cubic feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston per stroke,	2.115 "
Square feet of immersed amidship section per cubic foot of space displacement of piston per stroke, multiplied by number of strokes (20) per minute,	0·106 "

Paddle Wheel.

Overhung side paddle wheels of the common radial kind.

Diameter of wheel from outside to outside of paddles,	24 feet
Length of paddles,	7 " 9 inches.
Breadth of paddles,	1 " 6 "
Dip of paddles on trial trip,	3 " 8 "
Number of paddles in each wheel,	20
Areas of two paddles,	23·25 square feet.
Proportion of the areas of two paddles to immersed section of hull,	1·000 to 12·817

Boilers.

Two iron boilers of the double return drop flue variety.

Diameter of shells (circular shells from end to end,)	10 feet 6 inches.
Length,	24 "
Grate surface, (both boilers,)	112 square feet.
Heating " " "	2600 "
Proportion of heating to grate surface,	23,214 to 1000 "
Proportion of heating surface per cubic foot of space displacement of piston per stroke,	18,453 "
Proportion of heating surface per cubic foot of space displacement of piston per stroke, multiplied by number (20) of double strokes of piston per minute,	0·923 "

The boilers are provided with two fan blowers, 48 inches diameter, to be used if necessary. On the trial trip, it was impossible to ascertain with any exactness, what the consumption of coal was during the steaming.

Performance.

The vessel was tried in New York harbor and outside the Hook, January 1st, 1852. I have taken from the engineer's log of the trip, the speed, steam pressure, revolution of the wheels, &c., between points where they continued uniform, and the disturbing influences of wind and tide were but slightly felt or accurately ascertained. The results thus obtained will show fairly the performance of the vessel.

At 11 h. 3 m. A. M., the flag staffs on Governor's Island and Castle William were in range; at 11 h. 29½ m., the flag staffs on Forts Lafayette and Hamilton were in line; time, 26½ minutes; distance per Coast Survey, 6·75 statute miles; steam pressure in boiler, 25 lbs. per square inch, cut off ¾ths stroke; vacuum in condenser, 25 inches of mercury; double strokes of piston per minute, 22; tide slack; weather calm, shown by the flags drooping on their staves.

Speed per hour by Coast Survey Chart,	15·283 statute miles.
" " log thrown on board, 13 knots of 6140 feet, or	15·117 "
Slip of the centre of reaction of the paddles, calculated for the 15·283 statute miles,	15·45 per cent.
Oblique action of the paddles,	16·64 "
Sum of the losses by the paddle wheel,	32·09 "
Mean effective pressure on the piston per square inch, calculated for an initial cylinder pressure 2 lbs. less than boiler pressure, and for a back cylinder pressure 2 lbs. greater than condenser back pressure,	32 pounds
Actual power developed by the engine,	868·7 horses.

In continuation; ran to S. W. Spit, and rounded the buoy at 12 h. 12 m. P. M.; time, 42½ minutes; distance, 9·25 statute miles; steam pressure in boiler per square inch, 20 lbs., cut off at ⅜th stroke; vacuum in condenser,

25 inches mercury; double stroke of piston per minute, 19; wind and tide same as before.

Speed per hour by Coast Survey Chart,	13·059 statute miles.
Slip of the centre of reaction of the paddles,	16·34 per cent.
Oblique action of the paddles,	16·64 "
Sum of the losses by the paddle wheel,	32·98 "
Mean effective pressure on the piston per square inch, calculated as before,	25½ pounds.
Actual power developed by the engine,	595·77 horses.

In continuation; passed Sandy Hook at 12 h. 21 m. P. M.; distance, 2·00 miles; time, 9 minutes; steam pressure in boiler, 30 lbs. per square inch, cut off at ⅜th the stroke; vacuum in condenser, 25 inches; double strokes of piston per minute, 20½; light wind abeam, and ½ knot per hour head current.

Speed per hour by Coast Survey Chart,	13·333 statute miles.
To which add for current,	0·581 "
	13·914
Speed per hour by log thrown on board,	12⅜ knots of 6140 feet, or 14·201 statute miles.
Slip of the centre of reaction of the paddles calculated for the 13·914 statute miles,	17·39 per cent.
Oblique action of the paddles,	16·64 "
Sum of the losses by the paddle wheel,	34·03 "
Mean effective pressure on the piston per square inch, calculated as before,	34.07 pounds.
Actual power developed by the engine,	874·72 horses.

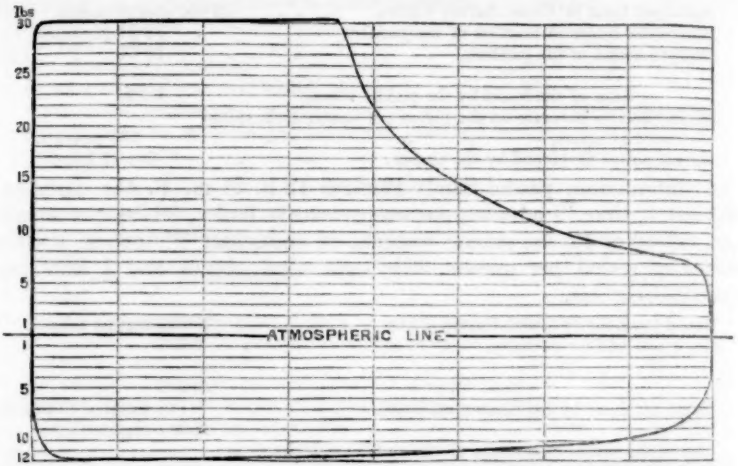
In continuation, ran, with a moderate sea on, (now steaming at sea,) to the Lightship, and was abreast of it at 1 h. 6 m. P. M.; moderate wind a little aft the beam; time, 45 minutes; distance, 8·25 miles; steam pressure in boiler, 27½ pounds per square inch, cut off at ⅜th the stroke; vacuum in condenser, 25 inches; double strokes of piston per minute, 20; wind on beam.

Speed per hour by Coast Survey Chart,	11 statute miles of 5280 feet. or 9·459 knots of 6140 feet.
Slip of the centre of reaction of the paddles,	33·06 per cent.
Oblique action of the paddles,	16·64 "
Sum of the losses by the paddle wheel,	49·70 "
Mean effective pressure on piston, calculated as before,	34·3 pounds.
Actual power developed by the engine,	843·55 horses.

It will appear from the foregoing, that the mean slip of the paddles in still water and calm weather, taken from the first two computations, is $\left(\frac{15{\cdot}45+16{\cdot}34}{2}\right)$ 15·895 per cent; and that the effect of a light wind abeam was sufficient to increase this slip to 17·39 per cent. in still water; while the effect of a moderate wind abeam, coupled with a moderate sea, increased the slip up to 33·06 per cent.

While at sea, the vessel was tried under canvass alone with a moderate wind on the quarter, when she made 4½ knots per hour, dragging the wheels, which were stationary. She was also turned under canvass alone, reversing the direction of her head in 5 minutes.

The accompanying indicator diagram is appended to show the working of the valves, &c.; the cut-off was Sickel's, and momentarily adjustable.



Steam pressure in boiler above atmosphere per gauge, 32 lbs.; vacuum in condenser, 25 inches of mercury; double strokes of piston per min., 22.

For the Journal of the Franklin Institute.

The Steam Navy of the United States now consists of

		In.		Ft.	
Mississippi,	Side Wheel, Double Engines,	75	×	7	Refitting at Philada.
Susquehanna,	" "	70	×	10	East India Squadron.
Powhattan,	" "	70	×	10	Building at Norfolk.
Saranac,	" "	60	×	9	Gulf of Mexico.
San Jacinto,	propeller, "	62½	×	4⅛	Mediterranean.
Michigan,	side wheel, "	36	×	8	Lake Erie.
Fulton,	" Single Engine,	50	×	10½	Fitting out at N York.
Princeton,	propeller, double "	56	×	3	" " Boston.
Water Witch,	side wheel, single "	36	×	6	Repairs at Washingt'n.
Vixen,	" " "	36	×	6	Gulf of Mexico.
Alleghany,	propeller, double "	60	×	4	Repairs at Norfolk.

In addition to the above, there are several small steam vessels (tenders) at the several navy yards, that could, to some extent, be used as transports for moderate distances.

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*The Holyhead Steamers.**

The most successful effort at producing fast steamers has resulted from the competition which the Board of Admiralty induced for separate designs for four steam packets, to occupy the station between Holyhead and Kingstown. The four constructors who submitted plans for these vessels

*From the Glasgow Practical Mechanic's Journal, for December, 1851.

were Sir Wm. Symonds, for the *Caradoc;* Mr. Oliver Wm. Lang, of Chatham dock-yard, for the *Banshee;* Messrs. Miller and Ravenhill, for the *Llewellyn;* and Mr. John Laird of Birkenhead, for the *St. Columba.* The following table states the principal dimensions of these vessels, and also some other information, showing their active and relative capabilities of speed.

PARTICULARS.	Caradoc.	Banshee.	Llewellyn.	St. Columba.
	ft. in.	ft. in.	ft. in.	ft. in.
Length between perpendiculars,	193 0	189 0	190 0	198 6½
Breadth of vessel,	26 9	27 2	29 6	27 3
Breadth over paddle-boxes,	—	49 6	—	43 6
Depth in hold,	14 9	14 9	—	15 5
Draft of water, forward,	—	8 10	—	9 2
Draft of water, aft,	—	9 2	—	8 7½
Light displacement in tons,	260	270	323	272
Burthen in tons,	662	670	654	719
Diameter of paddle wheels,	25 6	25 0	30 0	28 0
Nominal horse power of engines,	350	350	350	350
Diameter of cylinder in inches,	74	72	68	70
Length of stroke,	6 0	5 6	4 4	5 6
Revolutions per minute,	28	30	27	25½
Breadth of paddle wheel,	8 0	9 0	8 6	6 0
Dip of paddle wheel,	—	5 6½	—	5 6½
Area of paddle wheel,	—	33 9	30 10½	27 0
Area of the midship section,	—	190 0	—	—
Time occupied in making shortest passage between Holyhead and Kingstown, from 1st Aug. to 31st Dec., 1848,	h. m. s. 4 0 0	h. m. s. 3 26 0	h. m. s. 3 41 0	h. m. s. 3 56 0
Rate in knots per hour,	14·0	16·32	15·2	14·23
Rate in miles per hour,	16·13	18·80	17·5	16·37
Time of longest passage,	5 52 0	5 23 0	5 28 0	6 23 0
Rate in knots per hour,	9·5	10·4	10·24	8·77
Rate in miles per hour,	10·94	12·0	11·79	10·10
Average time of passage,	4 30 0	4 2 48	4 15 30	4 38 48
Rate in knots per hour,	12·45	13·84	13·10	12·05
Rate in miles per hour,	14.34	15·95	15·10	13·00
	lbs.	lbs.	lbs.	lbs.
Pressure on the safety valve,	14	14	20	14
Time of making shortest passage from 1st Jan. to 1st March, 1849,	h. m. s. 3 59 0	h. m. s. 3 36 0	h. m. s. 3 37 0	h. m. s. 4 8 0
Time of longest passage,	5 16 0	7 43 *0	4 50 0	6 30 0
Average time of passage in 1848-9,	4 31 25	4 3 8	4 9 30	4 40 42
Shortest time of passage, from 1st Aug. to 1st Oct., 1849,	3 54 0	2 26 0	3 36 0	4 3 0
Average time of passage, from 1st Aug. to 1st Oct. 1849,	4 26 0	4 3 0	4 6 0	4 40 0

The ordinary performances of these four packets, as well as their performances especially under trial, have determined their relative merits. Their service is one that demands at all times the greatest effort that can be made; and therefore it is no doubt quite fair to conclude that they have done all that they are capable of doing, and that the following order of merit is strictly correct: *Banshee*, first; *Llewellyn*, second; *Caradoc*, third; *St. Columba*, fourth. It will be observed that the pressure of steam

* This passage was made in a state of weather so bad, that no other steam packet ventured to attempt it on that day.

kept up was the same (14 lbs. on the valve) in all except the *Llewellyn*, in which it was 20 lbs. Sufficient time has elapsed to sanction the inference thus drawn of relative excellence as to speed, whilst there is no doubt that each of them bears a character of very high order.—*Fincham.*

Remarks on the Propeller Steamship S. S. Lewis.

This propeller steamship has recently arrived in Boston, after a passage of about 24 days from Liverpool, 20 of it being expended in reaching Halifax, where she arrived short of fuel. It will be remembered that this vessel was constructed in this city during the past season, and was sold to a Boston house, to run from thence to Liverpool. She left there some time during the month of November, and made the passage to within 300 miles of her destination in 11 days, when she broke the blades of her propeller, and was obliged to finish the trip under canvass. On reception of this news, we were informed that she had made this passage *against* head winds and gales; and although every steamer that arrived from Liverpool, reported strong westerly winds, which are unusual at that season of the year, yet we find from the reports of the Lewis, that with her the winds were from the east; a most singular phenomenon, to which I respectfully call the attention of Lieut. Maurey. Very soon after the arrival of the Lewis at Liverpool, the following card appeared in the Public Ledger of this city:

Propellers vs. *Side Wheels.*

Messrs. Editors—After waiting in vain for some days for some abler pen than mine to notice the great triumph of the "Propeller," in the case of the unprecedented passage of the "S. S. Lewis," I have determined that it should not pass without remark. I say passage, for although some three hundred and odd miles were yet to be accomplished at the time she was disabled, yet it would be fair to infer that during another twenty-four or thirty hours she could have reached her destination, had she not met with the accident. Now, what will the advocates of side wheels say to a ship of her size and limited power, on her first trip, against head winds and gales, making the passage short of twelve days? Is it irrational, under the circumstances, to look for her to cross the Ferry in ten days, after making a few trips, and getting every thing in proper trim? I think not; and I am still more confirmed in my oft expressed opinion, that one-half the power lavished on the side wheel ships would be sufficient to keep up their present speed, were they altered to propellers. The time is coming, I predicted years ago, when we will wonder at the excessive prejudice which has led to squandering millions of dollars.

Now, gentlemen, I have a small crow to pick with the worthy members of the press. Is it their excessive modesty which leads them to overlook all home-made productions as soon as removed from the limits of our village? If this feat had been performed by a British ship, all England would applaud, and we would re-echo their laudations. If the "Lewis" had been a New York, Boston, or Baltimore ship, the news of her trip would have been paraded with encomiums in every newspaper far and near. Why cannot or will not the conductors of the Philadelphia press give the praise that is fully due our excellent mechanics, and our enterprising fellow citizen, R. F. Loper, the projector and builder of the "S. S. Lewis!" Certainly they all deserve it, and a feeling of gratified pride would be no small incentive to new and superior productions. M.

And it is with this article that I have to do. I wish to show to the citizens of this city that every exaggerated statement of this kind does us an injury, and that a proper regard for truth is essential even in reports of steamers, a point where I believe it is not generally expected to be found to any great extent.

In examining the above article by M., it will be observed that he states in effect as follows:

1st, That the Lewis is a large ship with small power.

2d, That if she had not broke her propeller, she would have made the passage in twelve days, against head winds and gales.

3d, That she *will* cross the Ferry, as he calls it, in ten days.

4th, That half the power lavished on side wheel steamers would enable them to maintain their present rates of speed, if they were altered to propellers.

He then gives it as his opinion that the time is coming, which he has often predicted, when we shall wonder at the excessive prejudice which has led to squandering millions of dollars, (on side wheel steamers I suppose he means.) Now, the man who deceives himself is to be pitied, but he who deceives others deserves no such consideration. To which class does M. belong?

The following statements are founded on fact:

1st, That the Lewis has as much power as most side wheel steamers of her tonnage, for she has two boilers, 21 feet long, 11 feet 6 inches wide, and 11 feet 2 inches high, containing full 5600 feet of fire surface; and as she is only about 1150 tons Custom House measurement, it follows that she has nearly 5 feet of fire surface per ton, while there is not a side wheel steamer out of the port of New York, having boilers of *similar* character, that has as great a ratio; they usually have from 3 to 4 square feet per ton. The amount of boiler that a steamer has is the measure of her power.

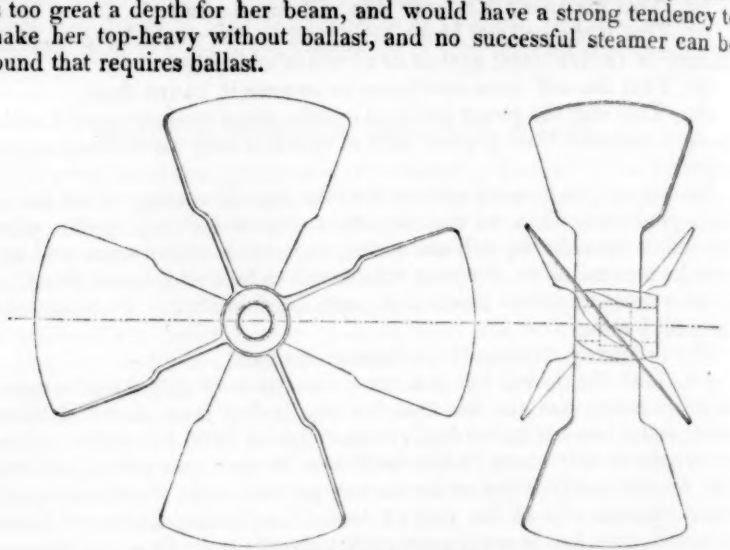
2d, I say she did not have head winds and gales during *the whole* of her passage, or any considerable portion of it; for the reason that every steamer coming westward, reported heavy head winds, (which usually prevail at that season of the year,) and the wind does not blow in two opposite directions at the same time; and also because on her return trip, when there is no question but the wind was ahead, she was 20 days in reaching Halifax. Now, both accounts cannot be correct, (the latter we know is,) or the easterly gales and head winds do not compare with those from the west.

3d, She will not cross *the Ferry* in 10 days, for she no doubt did her best on the first trip, and that would not have been done in 12 days, even without accident.

4th, Half the power of a side wheel steamer put into a propeller, would not enable her to be equal in speed to the former; on the contrary, no propeller can be found, having equal power, that can maintain equal speed to a side wheel steamer at sea, and no line of propellers can be found running in successful competition with side wheel steamers. By successful competition, I mean making as good time, or obtaining as high rates of freight and passage money.

The City of Philadelphia has for the past few years been noted for the number of propellers that have been built here, through the enterprise of one of her most active citizens; they are rightly considered a valuable addition to our merchant or naval service, and I have no wish to say aught against them. But I am utterly opposed to that system which makes every man a hero, or every propeller a Pacific; modest merit does not blow its own horn.

The dimensions of the S. S. Lewis are as follows:—Length, 225 feet; beam, 32 feet; depth, 27 feet; and in addition, a house on deck, which is too great a depth for her beam, and would have a strong tendency to make her top-heavy without ballast, and no successful steamer can be found that requires ballast.



Scale, 3-16 in. to one foot.

Her engines are two in number, connected at right angles. Diameter of each cylinder, 60 inches; length of stroke 40 inches. The crank shaft carries a large spur wheel, which gears into a pinion on the propeller shaft, and drives the latter $1\frac{3}{4}$ revolutions to 1 of the former. The propeller is of cast iron, of the following dimensions and form:—Diameter, 13 feet; angle at hub, 30°; angle at periphery, 50°; pitch at periphery, 34 feet; pitch at hub, 11 feet. FULTON.

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*Improvements in the Manufacture of Gas.**

The competition which has of late years sprung up in the supply of the important article of gas to the inhabitants of the large towns of the United Kingdom, has not existed long without the production of one of its legitimate effects. It has drawn the attention of parties skilled in the chemistry of gas manufacture, and careful observers of the circumstances under which the best results are obtained, to the study of improved methods of treating the various substances capable of being used in the production of gas; and the first fruits are visible in the process lately patented by Messrs. Barlow and Gore, which, in the opinion of some of our most experienced gas engineers, is destined to produce a speedy revolution in the manufacture of gas, and materially to diminish the cost of its production.

The processes are based, 1st, Upon an improved method of rendering luminous the gases resulting from the perfect decomposition of water or steam; and, 2d, Upon the conservative influence which hydrogen exer-

*From the London Mining Journal, No. 845.

cises in protecting the matter upon which the illuminating power of gas depends from decomposition by heat.

The first has been attempted by Donovan, Manby, White, Webster, and others, with dubious and disputed success. Their failures are all traceable to the same sources—first, to the impossibility of insuring the complete decomposition of the water or steam by any of the means employed by them, and to the consequent production of a large quantity of vapor, exercising a fearfully destructive influence over the carbonaceous matter undergoing decomposition for the purpose of rendering the water gases luminous; and, secondly, to the presence in the water gases of from 10 to 15 per cent. of carbonic acid, the injurious effects of which upon the flame need not be here further alluded to, and the expenses of abstracting which by any of the ordinary methods are so considerable as materially to augment the cost of manufacture, besides diminishing the volume of saleable gas. The present patentees propose to obviate these difficulties by first *condensing* the water gases, so as to deprive them of all excess of vapor, and then to pass them through a heated retort containing carbonaceous matter, by which the whole of the carbonic acid gas will be converted into twice its bulk of carbonic oxide gas, and the pure hydrogen and carbonic oxide gases in equal volumes, free from carbonic acid, are afterwards admitted in regulated quantities into retorts where carbonaceous matter is undergoing distillation or decomposition, and by which they are rendered highly luminous. The conservative effect of hydrogen upon olefiant gas has not, we believe, hitherto been noticed by chemists. It may, however, be demonstrated by the following very simple experiment:—If olefiant gas be passed through a red-hot tube, the carbon will be deposited, and the gas be thereby converted into light carburetted hydrogen, a gas of very low illuminating power. If, however, hydrogen be added to the olefiant gas, the same process may be repeated without causing any deposition of carbon, and with only a diminution of illuminating power in the mixed gases, due to the increased volume of the non-illuminating gas—hydrogen.

The practical effect of this property, when applied to gas making, is to reduce the quantity of condensible products, such as tar, &c., and entirely to prevent the deposit of carbon on the interior surfaces of glass retorts.

The importance of these discoveries will be readily understood, when we state that the experience of the patentees leads them to the conclusion that upwards of fifty per cent. may be added to the volume of gas yielded by all descriptions of materials ordinarily used for that purpose, without any diminution of the illuminating power, so that 15,000 cubic feet will be the probable future produce from one ton of Newcastle coal, and 75,000 cubic feet of London gas from the same quantity of Boghead Cannel, the ashes from which are further stated to be the best material known for the manufacture of alum; the residue, after the abstraction of the alumina, being also valuable for the manufacture of pottery, porcelain, and glass, and as a dentifrice, a polishing powder, and decolorant—truly we live in an age of invention and wonders. We may add that the Chartered Gas Company of London, the patriarch of gas companies, have agreed with the patentees for licenses to use the processes at all their works.

For the Journal of the Franklin Institute.

On the Friction of Marine Engines. *By* J. V. Merrick.

In the calculations deduced from experiments for ascertaining the power employed in the propulsion of steam vessels, it is important to determine the loss in utilized effect, resulting from the friction of the engine. This loss has been variously stated by different authors, who have, however, so far as I am aware, given only approximate estimates, without calculating it from known data. Exact results cannot, it is true, be obtained, because the condition of the "journals" or rubbing surfaces varies so constantly, whether from improper keying up, or imperfect lubrication, that the same engine would give very different coefficients at different times. It would, however, be interesting to inquire what is the friction incident to a normal state of affairs, and upon that basis, make allowances according to the circumstances of any special case.

The losses consequent upon friction may be stated as follows: 1st, the friction on the rubbing surfaces depending on the weight; 2d, the friction and resistance of the air to the moving parts; these, with the force required to work the air and feed pumps, and the valves, with the friction of these forces, make up a sum, which expresses what is called the "power to work the engine without load." If to this we add, 3d, the friction of the load put upon the engine, we shall have expressed all the deductions to be made from the gross power developed by a marine engine, in order to find that transmitted to the wheels or propeller.

Of these causes of loss, the (2d) resistance of the air to the moving parts, is too trifling to enter into a calculation of practical value. That of the air pump varies, of course, with the head against which the waste water is discharged, with the vacuum attained, etc.; but as an average for marine side lever engines, upon which form the present calculation is based, (when steam is expanded two to three times,) it has been found by indicator diagrams, to vary from 6 to 7 pounds per square inch of area of the air pump. When the latter has a capacity of $\frac{1}{5}$th the cylinder, the resistance in pounds per square inch of cylinder piston would be $r = \frac{(6+7)\times\cdot20}{2\times2} = 0{\cdot}65$; since the air pump piston makes but one working stroke, while that of the cylinder performs two. If the ratio of capacities be ·22, then $r = \frac{6{\cdot}5\times\cdot22}{2} = 0{\cdot}715$, and if ·24, then $r = \frac{6{\cdot}5\times\cdot24}{2}$ $= 0{\cdot}78$; if only ·18, $r = \frac{6{\cdot}5\times\cdot18}{2} = {\cdot}585$. Hence it may be stated in general terms, that the mean resistance caused by the air pump, is $\frac{7}{10}$th pound per square inch of the steam piston.

The friction of journals was found by Morin, (*Lecons de Mécanique Pratique*, 1*re Partie*,) to be unaffected by the velocity and extent of surface, and dependent simply on the pressure. The coefficient is stated to be ·05 the pressure when lubrication is constantly applied, and ·075 when it is renewed from time. As the latter is generally the case, we shall employ that coefficient.

The power required in a given time, to overcome the friction of any journal, will therefore be the product of this coefficient, by the mean pressure exerted upon it, and by the distance passed over by a point in the circumference of the journal during that time. Hence, the greater the diameter of a journal, other things being equal, the greater will be the friction, because with the same angular motion, a point in the circumference passes over a greater distance.

In calculating the friction without load, I shall take for an example a side lever engine of 72 inch cylinder, 8 feet stroke, of which I have the weights; a similar process may be applied to any other description of engine with equally correct results.

In this instance, if D represents the diameter of the cylinder, that of the main shaft journals is 0·2 D; outboard journals, 0·14 D; crank pins, 0·125 D; end beam pins, 0·084 D; air pump beam pins, 0·06 D; side lever centres 0·167 D; the angular motion of the side lever during a double stroke is 0·28 × circumference; hence the distances passed over during that time will be respectively—end beam pins, ·28 × 3·1416 × ·084 D=0·074 D; main journals, 3·1416 × ·2D=0·63 D; outboard journal, S=0·44 D; crank pin=0·39 D; side lever centre,=0·145 D; air pump beam pins=0·053 D.

The weights in round numbers are, on the outboard journals, 62,000 lbs., main journals, 31,000; crank pin, 4000; cross tail pins, 12,000; side rod pins, 16,000; air pump pins, 6000, and on the side lever centres, 56,000. The friction of weight will therefore be, (remembering that D=6 feet,)

Main journals,	·075 × 31,000	× ·63	D=	8790 lbs.		lbs.
Outboard journals,	" × 62,000	× ·44	" =	12276 "	21,066	"
Crank pin, weight,	" × 4,000	× ·39	" =	702 "		
" " previous friction	" × 21,066 ÷ 16	× ·39	" =	232 "	934	"
Cross tail pins, weight,	" × 12,000	× ·074	" =	400 "		
" " previous friction,	" × 2,000 ÷ 16	× ·074	" =	46 "	446	"
Air pump pins, weight,	" × 6,000	× ·053	" =	138 "	138	"
Side rod " "	" × 16,000	× ·074	" =	533 "		
" " previous friction,	" × 2,446 ÷ 16	× ·074	" =	47 "	580	"
Side lever centres, weight,	" × 56,000	× ·145	" =	3660 "		
" previous friction	" × 44,992 ÷ 16	× ·145	" =	184 "	3,844	"
					27,008	

Whole friction for a double stroke,

Therefore, the power required to be developed by the engines=area of cylinder × twice stroke × x.=27008, and x=pressure in pounds per square inch of piston=$\frac{27{,}008}{4071 \times 16}$=0·36, or allowing for imperfect lubrication, say ½-pound.

To this must be added, the friction of packing in the cylinder and pumps; an element very difficult to fix upon, as it depends entirely on the description and condition of the packing employed. In the absence of direct experiment, observation induces me to believe that this friction in well kept packing, does not exceed from ½ to 1 pound per square inch of rubbing surface, which on a 72 inch cylinder with rings 5 inches deep, would amount to, from 615 to 1230; in that case, the area of piston, being 4071, the pressure required would be $\frac{615}{4071}$ to $\frac{1230}{4071}$=0·15 to 0·30 lbs. For the air pump, the same assumption would give per square inch of its area,

0·22 to 0·43, which by ·21 (ratio of capacities,)=0·046 to 0·092 lbs. on the steam piston. Finally, the friction of the power required to work the air pump is almost inappreciable, (about $\frac{1}{4}\frac{1}{0}\frac{1}{0}$th of a pound per square inch,) and may be neglected without serious error.

Summing up these elements we have,

1. Power to work the air pump,	0·585 to	0·780
2. Friction of weight,	0·500 "	0·500
3. " cylinder packing,	0·150 "	0·300
4. " air pump packing,	0·046 "	0·092
5. Power to work balance valves, Friction of Parallel motion, Resistance of the air, &c.	say 0·169 "	0·178
To work the engine without load,	1·450 "	1·850

Mean $\frac{1\cdot450+1\cdot050}{2}$=1·65 pounds per square inch. If the journals were kept constantly lubricated, as is the case when automaton lubricators are employed, the friction of weight would be only $\frac{\cdot50\times\cdot05}{\cdot075}$=·33, and the pressure would be reduced to 1·65—·17=1·48 pounds per square inch. It therefore appears to me that 1·75 and 1·50 pounds would be a just allowance in these two cases respectively.

There now remains to be considered, the value of the friction of any load which may be put upon an engine of this description. It would be a tedious operation to obtain this with perfect accuracy, because, beginning at the cylinder with a given pressure, the friction of the several parts would gradually diminish it, until, arriving at the shaft journals, it would be less by the whole friction of the engine. But it may be found with sufficient exactness for our present purposes, as follows:

Calling P=the mean pressure on the piston, over and above that required to work the engine without load, and A=the area of the cylinder in inches, then, as D=6 feet,

Friction on side rod pins	= ·075 AP	× 0·74	D=	·0333AP
" crosstail pins	= AP	× 0·74	"	·0333 "
" side lever centres	= 2 AP	× 0·145	"	·1305 "
" crank pin	= $3\frac{2}{1}\frac{1}{4}$ AP	× 0·39	"	·1118 "
" main journals	= $3\frac{2}{1}\frac{1}{4}$ AP	× 0·63	"	·1813 "
Total friction during a double stroke,				·4902 "

But as the whole power developed in this time is AP×2S (S=8)=16AP, therefore, $\frac{\cdot4902}{16}$=0·0307, the proportion of the whole power employed in overcoming friction of load, or if automaton lubricators be used, ·0307×$\frac{\cdot05}{\cdot075}$=0·0205, or two per cent. When it is recollected that this calculation is based upon perfect keying up, and proper lubrication, points which are generally not so well looked to as they should be, it does not appear that 4 and 5 per cent., respectively, are far from the true value of friction in ordinary cases.

The friction of any other form of engine might be calculated in the same manner, and I think a comparison would show that the side lever engine is not *quite* so much behind some others in this point of view, as has been commonly supposed.

*Steam Marine of the United States.**

At the last session of Congress, the Senate, by resolution, directed the Secretary of the Treasury to collect and report statistics, exhibiting officially the External and Internal Steam Marine of the United States. William D. Gallagher, Esq., was commissioned to obtain the Inland, and Professor E. D. Mansfield the External; and most faithfully and ably have they discharged the arduous duty. The aggregate results far exceed, in magnitude and importance, the most extravagant estimates and anticipations. These reliable facts and statistics were reported to the Senate on Thursday last, by the Secretary of the Treasury. We take the subjoined statements from that Report:

The Steam Marine of the United States, on the Atlantic and Pacific Coasts and the Gulf of Mexico, is as follows:

From Passamaquoddy Bay to Cape Sable, there are 46 ocean steamers; 274 ordinary steamers; 65 propellers, and 80 ferry boats. Tonnage, 154,270 tons. High pressure steamers, 116; low pressure, 342. Number of officers and crews, 8,348. Passengers annually, 33,114,782. Average miles traveled, 8,118,989. These statistics refer to the year ending July 1, 1851.

The steam marine on the Gulf of Mexico, from Cape Sable to the Rio Grande, consists of 12 ocean steamers; 95 ordinary steamers; 2 propellers. Tonnage, 23,244. High pressure, 97; low pressure, 10. Number of officers and crews, 3,473. Passengers during the year, 148,700. Number of miles traveled, 1,360,380.

The steam marine on the Pacific Coast consists of 37 ocean steamers; 13 ordinary steamers. Tonnage, 34,986. High pressure, 3; low pressure, 47. Officers and crews, 1949. Average miles traveled, 79,209.

The aggregates of the external steam marine are:

Ocean steamers, 96; ordinary steamers, 382; propellers, 67; ferry boats, 80. Total, 625. Total tonnage, 212,500. High pressure, 213; low pressure, 412. Officers and crews, 11,770. Annual passengers, 33,342,846. Of the annual passengers, 24,009,550 were by ferry boats.

The Shipwrecks in the United States, on the Atlantic and Pacific Coasts and Gulf of Mexico, during the year ending July 1, 1851, were 50 ships, 59 brigs, 190 schooners, 9 sloops, and 20 steamers. Total, 328; of which 278 were by tempest, 14 by fire, 15 by collision, 19 by snags, and 2 by explosion. The number of lives lost was 318.

The "human movement," by steamboat, on the principal tide water lines was as follows:

	No. of Pass'rs.
On Long Island Sound,	302,397
On Hudson River,	995,100
Between New York and Philadelphia by Steamers,	840,000
On Potomac and James Rivers and Chesapeake Bay,	422,100
Gulf of Mexico,	169,508
Pacific Coast,	79,209

In 26 Districts on the Atlantic Coast, there were 160 vessels lost, valued at $1,559,171, and on which insurance was paid to the amount of $968,350.

* From the New York Tribune, January 26, 1852.

In New York, the marine insurance paid was . . .	$ 3,520,161
In Philadelphia, ...	906,616
In Boston, ...	554,865

The total marine (not inland) insurance paid during the year is estimated at $6,227,000.

The Inland Steam Marine of the United States comprises three grand divisions—the Northern Frontier, the Ohio Basin, and the Mississippi Valley:

	Steamers.	Tonnage.	Officers & Crew.	Passengers.
The Northern Frontier has	164	69,165	2,855	1,513,390
The Ohio Basin, . .	348	67,601	8,338	3,464,967
The Mississippi Valley,	255	67,957	6,414	882,593
Total, . .	765	204,723	17,607	5,860,950

Of the passengers, 2,481,916 were by ferry boats, and in addition to the above, there were 1,325,911 passengers by railroads, 86,000 by canals, and 27,872 by stages, on the Northern Frontier line of travel, and 265,936 railroad and 28,773 stage passengers on the Ohio Basin line.

Travel to and from Inland Commercial Centres.

Pittsburgh (last year), ...	466,856
St. Louis, ...	367,795
Buffalo, ...	622,423
Chicago, ...	199,883
Total, ...	1,656,957

The resident population of these four cities is but 217,966.

The travel to and from Buffalo "comes and goes" as follows:

By ordinary steamers, ...	157,257
Propellers, ...	14,300
Ferry Boats, ...	26,280
Buffalo and Rochester Railroad, ...	262,386
Niagara Railroad, ...	119,200
Erie Canal, ...	43,000
Total, ...	622,423

St. Louis has 131 steamers; New Orleans, 109; Detroit, 47; Buffalo, 42; Pittsburgh, 12. During eight years, ending July 1, 1851, the tonnage in the Buffalo District has increased 19,217 tons; in Presque Isle, 2778; Cuyahoga, 4563; and in Detroit, 14,416. The steamboat tonnage of the Upper Lakes has more than quadrupled in eight years, and on the Mississippi Valley it has doubled in nine years.

The steamboat disasters on the Mississippi and tributaries since the introduction of steam to the year 1848, are, by collision, 45; fire, 104; snags, 469—total, 618. The original cost of the boats, $9,899,748; deficiency in value, $5,176,757; final losses, $4,719,991. The loss in 1849 is stated at $2,000,000.

Losses on the lakes and rivers during the year ending July 1, 1851, by tempest, 35; fire, 30; collision, 18; snags, 32. Persons lost on the lakes, 87, and on the rivers, 628—total, 695.

The average tonnage of Lake steamers is 437 tons; of the Ohio Basin, 206; and of the Mississippi Valley, 273.

Of the 558 ordinary steamers on the rivers, 317 are enrolled in the Districts of the Ohio Basin, and 241 in those of the Mississippi Valley.

Of the 147 ordinary steamers and propellers on the Lakes, 31 are enrolled on the Lakes Champlain and Ontario and the St. Lawrence, 66 on Lake Erie, and 60 at Detroit and the Lakes above.

Of the 164 steam vessels on the Lakes, 105 are ordinary steamers, 52 are propellers, and 43 are ferry boats.

Of the 601 steam vessels on the rivers, 558 are ordinary, and 43 are ferry boats.

With but two very slight exceptions, there is an uninterrupted line of steam navigation from the waters of the Gulf of St. Lawrence to those of the Gulf of Mexico—a distance of about 28,000 miles, and upon which is employed, for the purposes of trade and travel, a steam tonnage of 60,166 tons. The Ohio Basin forms, of itself, a cross section of about 1100 miles in length.

The steam marine of Great Britain and her dependencies is stated to consist of 1184 boats, with 142,080 tonnage; while the inland steam marine of the United States consists of 766 boats, with a tonnage of 204,613 tons—showing that, exclusive of the steam tonnage of the Atlantic and Pacific seaboard and the Gulf coast, the inland steam tonnage exceeds that of Great Britain and her dependencies by 62,533 tons.

On the Production of Instantaneous Photographic Images. By H. F. Talbot.*

It will probably be in the recollection of some of your readers that in the month of June last a successful experiment was tried at the Royal Institution, in which the photographic image was obtained of a printed paper fastened upon a wheel, the wheel being made to revolve as rapidly as possible during the operation.

From this experiment the conclusion is inevitable, that it is in our power to obtain the pictures of all moving objects, no matter in how rapid motion they may be, provided we have the means of *sufficiently* illuminating them with a sudden electric flash. But here we stand in need of the kind assistance of scientific men who may be acquainted with methods of producing electric discharges more powerful than those in ordinary use. What is required is, vividly to light up a whole apartment with the discharge of a battery:—the photographic art will then do the rest, and depict whatever may be moving across the field of view.

I had intended to communicate much earlier the details of this experiment at the Royal Institution, but was prevented from doing so at the time,—and soon afterwards I went on the Continent in order to observe the total solar eclipse of the 28th of July. This most interesting phenomenon I had the pleasure of witnessing at the little town of Marienburg, in the north-eastern corner of Prussia. The observations will appear, I believe, in a forthcoming volume of the Transactions of the Royal Astronomical Society. Among other things, I was enabled to make a satisfactory estimate of the degree of darkness during the total obscuration, which proved to be equal to that which existed one hour after sunset the same evening, the weather being during that evening peculiarly serene, so as to allow of a just comparison.

* From the London Athenæum, December, 1851.

This Continental journey having effectually interrupted my photographic labors, I have only recently been able to resume them. I shall, therefore, now proceed to describe to you exactly the mode in which the plates were prepared which we used at the Royal Institution: at the same time not doubting that much greater sensibility will be attained by the efforts of the many ingenious persons who are now cultivating the art of photography. And it is evident that an increased sensibility would be as useful as an augmentation in the intensity of the electric discharge.

The mode of preparing the plates were as follows:—

1. Take the most liquid portion of the white of an egg, rejecting the rest. Mix it with an equal quantity of water. Spread it very evenly upon a plate of glass, and dry it at the fire. A strong heat may be used without injuring the plate. The film of dried albumen ought to be uniform and nearly invisible.

2. To an aqueous solution of nitrate of silver add a considerable quantity of alcohol, so that an ounce of the mixture may contain three grains of the nitrate. I have tried various proportions, from one to six grains, but perhaps three grains answer best. More experiments are here required, since the results are much influenced by this part of the process.

3. Dip the plate into this solution, and then let it dry spontaneously. Faint prismatic colors will then be seen upon the plate. It is important to remark, that the nitrate of silver appears to form a true chemical combination with the albumen, rendering it much harder, and insoluble in liquids which dissolved it previously.

4. Wash with distilled water to remove any superfluous portions of the nitrate of silver. Then give the plate a second coating of albumen similar to the first; but in drying it avoid heating it too much, which would cause a commencement of decomposition of the silver. I have endeavored to dispense with this operation, No. 4, as it is not so easy to give a perfectly uniform coating of albumen as in No. 1. But the inferiority of the results obtained without it, induces me for the present, to consider it as necessary.

5. To an aqueous solution of prot-iodide of iron add *first*, an equal volume of acetic acid, and then ten volumes of alcohol. Allow the mixture to remain two or three days. At the end of that time it will have changed color, and the odor of acetic acid as well as that of alcohol will have disappeared, and the liquid will have acquired a peculiar or agreeable vinous odor. It is in this state that I prefer to employ it.

6. Into the iodide thus prepared and modified the plate is dipped for a few seconds. All these operations may be performed by moderate daylight, avoiding, however, the direct solar rays.

7. A solution is made of nitrate of silver, containing about 70 grains to one ounce of water. To three parts of this add two of acetic acid. Then if the prepared plate is rapidly dipped once or twice into this solution it acquires a very great degree of sensibility, and it ought then to be placed in the camera without much delay.

8. The plate is withdrawn from the camera, and in order to bring out the image it is dipped into a solution of protosulphate of iron, containing one part of the saturated solution diluted with two or three parts of water. The image appears very rapidly.

9. Having washed the plate with water it is now placed in a solution

of hyposulphite of soda, which in about a minute causes the image to brighten up exceedingly, by removing a kind of veil which previously covered it.

10. The plate is then washed with distilled water, and the process is terminated. In order, however, to guard against future accidents, it is well to give the picture another coating of albumen or of varnish.

These operations may appear long in the description, but they are rapidly enough executed after a little practice.

In the process which I have now described, I trust that I have effected a harmonious combination of several previously ascertained and valuable facts,—especially of the photographic property of iodide of iron, which was discovered by Dr. Woods, of Parsonstown, in Ireland, and that of sulphate of iron, for which science is indebted to the researches of Mr. Robert Hunt. In the true adjustment of the proportions, and in the mode of operation, lies the difficulty of these investigations, since it is possible by adopting other proportions and manipulations not very greatly differing from the above, and which a careless reader might consider to be the same, not only to fail in obtaining the highly exalted sensibility which is desirable in this process, but actually to obtain scarcely any photographic result at all.

To return, however, from this digression. The pictures obtained by the above described process are negative by transmitted light and positive by reflected light. When I first remarked this, I thought it would be desirable to give these pictures a distinctive name, and I proposed that of *Amphitype*, as expressive of their double nature, at once positive and negative. Since the time when I first observed them, the Collodion process has become known, which produces pictures having almost the same peculiarity. In a scientific classification of photographic methods, these ought, therefore, to be ranked together as species of the same genus. These Amphitype pictures differ from the nearly related Collodion ones in an importance, viz., the great hardness of the film and the firm fixation of the image, which is such that in the last washing, No. 10, the image may be rubbed strongly with cotton and water without any injury to it; but, on the contrary, with much improvement, as this removes any particles of dust or other impurity, and gives the whole picture a fresh degree of vivacity and lustre. A daguerreotype picture would be destroyed by such rough usage before it was completely fixed and finished.

In examining one of the amphitype pictures, the first thing that strikes the observer is, the much greater visibility of the positive image than of the negative one; since it is not rare to obtain plates which are almost invisible by transmitted light, and which yet present a brilliant picture full of details when seen by reflected light.

The object of giving to the plates a second coating of albumen, as prescribed in No. 4, is chiefly in order to obtain this well developed positive image; for it is a most extraordinary fact, that a small change in the relative proportions of the chemical substances employed enables us at pleasure to cause the final image to be either entirely negative or almost entirely positive. In performing the experiment of the rotating wheel the latter process must be adopted; since the transmitted or negative image is not strong enough to be visible unless the electric flash producing it be an exceedingly bright one.

I now proceed to mention a peculiarity of those images which appear to me to justify still further the name of Amphitype, or, as it may be rendered in other words ambiguous image. Until lately I had imagined that the division of photographic images into *positive* and *negative* was a complete and rigorous one, and that all the images must be of either the one or the other kind. But a third kind of image of a new and unexpected nature is observed upon the Amphitype plates. In order to render this intelligible, I will first recall the general fact that the image seen by transmitted light is negative and that by reflected light positive. Yet, nevertheless, if we vary the inclination of the plate, holding it in various lights, we shall not fail speedily to discover a position in which the image is positive although seen by transmitted light. This is already a fact greatly requiring explanation. But the most singular part of the matter is, that in this new image (which I call the *transmitted positive*,) the brightest objects (viz: those that really are brightest, and which appear so in the *reflected positive*) are entirely wanting. In the places where these ought to have been seen, the picture appears pierced with holes, through which are seen the objects which are behind. Now, if this singularity occurred in all the positions in which the plate gives a positive image, I should be satisfied with the explanation that the too great brightness of the objects had destroyed the photographic effect which they had themselves at first produced. But since this effect takes place in the *transmitted positive* but not in the *reflected positive*, I am at a loss to suggest the reason of it, and can only say that this part of optical science, dependent upon the molecular constitution of bodies, is in great need of a most careful experimental investigation.

The delicate experiment of the revolving wheel requires for its success that the iodide of iron employed should be in a peculiar or definite chemical state. This substance presents variations and anomalies in its action which greatly influence the result. Those photographers, therefore, who may repeat the experiment will do well to fix their principal attention upon this point. It is also requisite in winter to warm the plates a little before placing them in the camera. In pursuing this investigation, I have been much struck with the wide field of research in experimental optics which it throws open. By treating plates with albumened glass with different chemical solutions, the most beautiful Newtonian colors, or "colors of thin plates," may be produced. And it often happens that the landscapes and pictures obtained by the camera present lively though irregular colors. These not being in conformity with nature are at present useless; with this exception, nevertheless, that in many pictures I have found the color of the sky to come out of a very natural azure blue. I hope soon to have the leisure requisite for pursuing this very interesting branch of inquiry, and in the mean time I venture to recommend it to the notice of your scientific readers.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, January 15, 1852.

S. V. Merrick, President, in the chair.

John F. Frazer, Treasurer.

J. Vaughan Merrick, Recording Secretary, P. T.

The minutes of the last meeting were read and approved.

A Letter was read from the Royal Geographical Society, London.

Donations were received from The Royal Astronomical Society, London; The Royal Irish Academy, Dublin; Ellwood Morris, Esq., Pittsburgh, Penn'a.; and Messrs. Charles E. Smith, Julius H. Rae, Percival Roberts, John C. Trautwine, William Firmstone, and A. W. Rae, Philadelphia.

A complete Geological suit of 700 Specimens, selected and arranged by the Mineralogical Institute of Heidelburg, Germany, accompanied by printed catalogues and printed labels in German, French, and English, was purchased and presented to the Institute by several of the members.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of December; also, his annual statement of the Funds of the Institute, and the annual statement of the transactions of the Journal of the Institute.

The Board of Managers and Standing Committees reported their minutes.

The Committee on the Library reported that they had so amended the regulations for the government of the Library, as to allow members to take from the Library, during the recess of the meetings of the Committee, books belonging to the "First Class," on obtaining the consent in writing of two members of the Committee.

On motion, the amendment was approved by the Institute.

The Committee on the School of Design for Women, and the Trustees of the Elliott Cresson Medal, not being prepared to report—Mr. F. Fraley made a verbal statement in relation thereto, and said that the regular reports in writing would be submitted at the next meeting of the Institute.

New candidates for membership in the Institute (15) were proposed, and the candidates (21) proposed at the last meeting were duly elected.

The Tellers of the annual election for Officers, Managers, and Auditors, for the ensuing year, reported the result, when the President declared the following gentlemen as duly elected:

Samuel V. Merrick, President.

Thomas Fletcher, Abraham Miller, } Vice Presidents.

Isaac B. Garrigues, Recording Secretary.

Solomon W. Roberts, Corresponding Secretary.

John F. Frazer, Treasurer.

MANAGERS.

M. W. Baldwin,	Owen Evans,	Eliashib Tracy,
Frederick Fraley,	Alan Wood,	Geo. P. Whitaker,
John Agnew,	Asa Whitney,	Jos. J. Barras,
John Wiegand,	Isaac S. Williams,	Geo. N. Eckert,
John C. Cresson,	H. P. M. Birkinbine,	Charles E. Smith,
John H. Towne,	Geo. W. Conarroe,	John C. Trautwine,
Edwin Greble,	Thos. J. Weygandt,	Wm. D. Parrish,
David S. Brown,	Peleg B. Savery,	Frederick Graff.

AUDITORS.

Algernon S. Roberts, Samuel Mason,
Uriah Hunt.

Dr. Rand exhibited to the meeting, through the kindness of Mr. Cornelius, a form of Argand Burner, having an annular jet, the inconveniences of which form of jet were obviated by the peculiar arrangement of concentric cones composing it, and the manner in which the supply of air is admitted and regulated. The photometric results of this burner will be communicated at a future meeting, in the report of which a more detailed account of its construction will be made.

Mr. Bartol gave an account of the operation of the combined Vapor Engine, which he had seen in a recent visit to New York.

Mr. G. W. Smith explained the method adopted at the establishnent of Reeves, Buck & Co., Phœnixville, Penn'a, for the manufacture of old and worn Railroad Bars, which he illustrated by drawings. He described the mode of piling, and the introduction of new iron. The form of the new pieces thus introduced could not be understood without engravings. A reference to the work of Valerius on the fabrication of Iron, exhibits a method somewhat analogous. Mr. S. stated that this establishment at Phœnixville was the only one, known to him, in the United States, where this very advantageous process had been introduced. In England and elsewhere, the usual method is to reduce the T rails, when worn, into the shape of flat bars, previous to piling and remanufacturing.

Prof. Cresson made a few remarks on the manufacture of Railway Bars, showing in what manner the hard and soft parts of the metal should be disposed to form the most perfect rail.

Prof. Cresson was requested to give some account of the late attempts to adapt locomotive engines to the use of anthracite as fuel. He stated that numerous contrivances for this purpose are now in course of trial on several of the railroads engaged in the transportation of this fuel to market, principally on the road from Philadelphia to Reading and Pottsville.

The chief difficulty in using anthracite in locomotives arises from the intensity of the local heat, when the combustion is at its height, by which the metal in contact with the fuel is rapidly destroyed. From the peculiar nature of the fuel, the tendency of the blast produced by the exhaust is to create a sort of unstable equilibrium in the action of the fire, or a tendency to excess on either side of the proper mean; thus the hotter the fire the higher the steam, and as this increases, the blast becomes sharper and the fire still more vehemently urged. Among the expedients heretofore tried for curing the evil, the most effectual have been the use of a blower instead of the exhaust blast, and a peculiar form of nozzle to the exhaust pipe, by which the force of the blast can be varied at will by the engineer. These have alleviated the difficulty, but not entirely cured it. The most recent scheme is that carried into practice by Mr. Mulhollend, the manager of the machine shops of the Philadelphia and Reading Railroad, which closely resembles one for which a caveat was filed in the Patent Office several years ago by Mr. M. W. Baldwin. It consists of two principal parts, one for shielding the fire-box by a stratum of coal in a state of imperfect combustion and consequent moderate heat, and the other for detaining and burning the gaseous carbonic oxide produced by the imperfect combustion of the coal. The first effect is obtained by having a broad plate or flanch of cast iron, placed around the fire grate

in contact with the walls of the fire-box. The part of the coal that rests on this shelf receives an insufficient supply of air for active combustion, and shields the iron of the boiler from the more active fire resting on the grate.

To provide for the detention and combustion of the carbonic oxide gas, the flues are made in two separate lengths, with a box or gas chamber interposed; the set of flues attached to the fire box being quite short and of larger calibre than usual, and those in the front end of the boiler of the usual diameter and nearly the usual length. Fresh air is admitted into the gas chamber from the ash pan, and the inflamed gas drawn through the forward flues by the blast of the exhaust. The only trouble experienced thus far in using these engines, is said to arise from the difficulty of keeping the short flues of large calibre perfectly steam tight, but it is believed that this will be removed by slightly diminishing their diameter, and that with this change, the results will be entirely satisfactory.

Mr. G. W. Smith, in compliance with his promise at the last meeting, gave some additional returns from the anthracite coal regions of Pennsylvania, which, added to those formerly given, presented a grand total of 5,100,000 tons mined in the State of Pennsylvania, during the last year, making an aggregate of bituminous and anthracite, of 7,500,000 tons nearly.

Mr. Smith requested the attention of the meeting to the necessity of Legislative enactments for the protection of buildings from fire; described the many disastrous conflagrations in Philadelphia, and other cities of the Union, with a comparative exemption of the cities of London and Paris; briefly described the mode of building prescribed by law in those cities, and the beneficial results therefrom; recommended the subject to the consideration of the Institute, by submitting the following resolution:

Resolved, That a committee be appointed to memorialize the Councils of the City of Philadelphia, to pass an ordinance to render buildings more secure against fire.

Mr. Fraley stated that by an Act of Assembly passed in the year 1832, full power had been given to the Corporation of the City of Philadelphia, to prohibit within the limits of said City, the erection of buildings of wood or other combustible materials. That it had also been empowered by the same act to fix and determine the height, thickness, and materials of the walls, and the general character of buildings thereafter to be erected in said city, with the special view of guarding, as far as might be possible, against the ravages and injuries of fire. He was not aware that any like power had been granted to the municipal corporations of the County of Philadelphia, and that therefore, the provision of the law, as it now stands, was only limited in its effect, and so far as he knew, had not yet been enforced in the city, further than to prohibit the erection of wooden and brick-paned buildings of a certain description. He hoped a strong expression of public opinion would now be made, calling upon the councils to execute the powers given to them by the act of 1832, and also upon the Legislature to extend them if necessary, and to make the law operative over the whole county.

On motion, the resolution was adopted, and the following gentlemen were appointed the

Committee.—Messrs. G. W. Smith, John C. Cresson, George Erety, John M'Clure, and Wm. T. Forsyth.